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SYMPOSIUM: Methods and Media for Culture of Tubercle Bacilli

I. RECENT DEVELOPMENTS OF CULTURE MEDIA FOR THE GROWTH OF TUBERCLE BACILLI:

With a New Method For Preparing Petragnani's Media

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A Preliminary Report

The original purpose of this paper was to determine the efficiency of the slide culture technique for the early growth of the tubercle bacillus as described by Berry and Lowry.[1] There is still a need for an economical media; that is, in its ingredients, in time and effort in its preparation when only one technician is at hand, and the time required for the positive identification of the organism. Commercially prepared is excluded from the start because of the cost. A rough estimate was made of the media used in a year's time; there was a difference of $20.00 against $175.00, excluding labor charges on the former. In surveying the time required for 226 cultures to be reported as positive, following a negative smear, the accompanying chart shows the percentages, using Petragnani's media, over a period of three years. Most all of the specimens were sputum.

Time (days)	Cultures (+)	Percentage (+)
18	2	0.9
19	6	2.7
21	5	2.2
24	14	6.1
25	11	4.9
26	15	6.7
27	6	2.7
29	9	4.0
30	10	4.4
32	12	5.3
33	15	6.7
35	14	6.1
37	10	4.4
39	13	5.8
40-60	84	37.1
Total	226	100.0

Lowry and Berry used a specially made culture tube measuring 180 mm. in length with an inside measurement of 35 mm. in diameter. 110 mm. from the closed end of the tube is an indentation 20 mm. in depth. The tube may be purchased from Hans L. Landsay, a scientific glassblower of Boulder, Colo. at $1.25 per tube. A special rack had to be built to hold the tubes upright and a great deal of extra incubator space made available as the tubes had to be placed in a horizontal position following inoculation. It would seem ideal and almost necessary to have a sterile culture room and one technician to do the work undisturbed. As cotton plugs could not be used in the sterilizing of the tubes due to the "inhibitory effect of distillates from the cotton on the tubercle bacillus,"[2] foil taken from X-ray films was fitted tightly over the tubes in several folds, and following sterilization, were replaced with sterile cotton plugs covered with cheesecloth tied at the top to facilitate handling. For each specimen six slides were smeared, fixed in 6% sulfuric acid and washed according to specifications and inoculated into separate tubes, each containing 20 cc. Kirchner's medium. Two slides were removed at the end of the 2nd, 4th, and 6th day respectively, stained and examined for the acid-fast bacillus. In spite of all aseptic techniques, suggestions, changes and precautions, there was at least 20% contamination. In summing up all the difficulties, time and cost, this procedure was not considered applicable for routine culture of the tubercle bacillus.

The outgrowth of these many unsuccessful attempts may prove to be value although utilizing the same media as recommended by Lowry and Berry in a different manner. The formula

for Kirchner's medium, with albumin added, as received from Dr. Berry, is as follows:

$Na_2HPo_4.12H_2O$	3 Gms.
KH_2Po_4	4 Gms.
$MgSo_4.7H_2O$	0.6 Gms.
Sodium Citrate	2.5 Gms.
Asparagin (Difco)	5 Gms.
Glycerin	20 cc.
Distilled water	1000 cc.

Dissolve in water and autoclave

Bovine Albumin Fraction V (Armour's) 5 Gms.

Dissolve in 100 cc. Normal Saline

Sterilize by filtration through Seitz EK filter

Add the sterile albumin solution to the cooled solution of salts, aseptically.

Approximately 7 cc. of the prepared media is added to a sterile 15 cc. centrifuge tube, and 0.2 cc. of the concentrate; mix by gentle rotation and incubate 6 days. Aluminum foil caps were used as in the original work; metal caps are now available (Aloes) and are far more easily managed. At the end of the 6 day period, the tubes are centrifuged, the supernatant fluid carefully poured off into a container that can be autoclaved, and the sediment smeared and stained. Upon examination it has been found that the organisms appear in large clumps, and can be readily found using the high-dry lens, the slide being covered with the immersion-oil first. Confirmation is then made by switching over to the oil-immersion lens. Equal amounts of the original concentrate were added to tubes of Petragnani's and incubated. To date, 4 original negative concentrates yielded a positive smear from the Kirchner's media in the 6 day period, which were confirmed by a positive Petragnani's culture in 26 days. An attempt is now being made to subculture the positive Kirchner's onto Petragnani's and to determine the effect in guinea pigs. Saphrophytes have been seen in the sediment, but they are easily determined; are large and bullet-shaped, some are even hollow.

In a recent series, a study was made to compare the efficiency in time of Petragnani's and Peizer's media (3), on known positive specimens with a high Gaffky count, reading the cultures once a week. The latter proved more efficient in time but the growth was more luxurious on the former. In spite of the high Gaffky count, the shortest time for a positive culture was 15 days. In another series of negative concentrates, inoculated on both media, there was no variation of the negative results at the end of the two month period. Peizer's media (Difco) comes in a dehydrated form accompanied by an enrichment liquid, formulae of which are published.[3] They are easily prepared in large

quantities and remain stable over a long period of time. The procedure in this laboratory is to purchase the dehydrated form and prepare the enrichment so that the media is always fresh when needed.

New Method for Preparing Petragnani's Media

The media is prepared in this Sanatorium, using the formula from Schaub and Foley,[4] with modifications. To many, the changes will seem to be absolute heresy, so the complete procedure will be given in detail, realizing that although it seems very simple, its the detail of these simple rules that guarantees a perfect batch each time. For the past three years various members of the Central Supply Department of this Sanatorium have worked on this project, making changes at the time when they appeared to be necessary.

Preparation of the media:

1 potato, peeled, size of egg, cut in very small cubes.
150 cc. milk
6 gm. potato flour, or French's Instant Potato Mix
1 gm. Bacto-peptone (Difco)
Cook over double boiler an hour, stir occasionally.
Make up loss of liquid by evaporation with more milk.
Cool to 50° C.
5 whole eggs
12 cc. glycerin
10 cc. 2% malachite green, aqueous solution
Mix thoroughly, and filter through cheese cloth, after egg mixture has been added to milk and potato mixture.
Chill 24 hours at 5-10° in refrigerator.

Sterilization of the Media

1. For correct slant of the media, put 6 cc. in a 5 inch tube, or 7 cc. in a 7 inch tube. Tighten the screw caps, then unscrew one half round.

2. Moisten sand as follows: 6 oz. water to each quart of sand, that has been sifted. For 18 to 20 tubes to be used, a shallow pan about 15 by 10 by 2 inches will suffice.

3. Cover bottom of pan with moist sand about ¾ inch deep. Press down firmly and evenly. Be sure there are no dry lumps.

4. Place a glass rod about 1 inch in from the side of the pan.

5. Place a paper towel on top of sand and rod so it will fold half and half over the tops of the tubes.

6. Place the tube of media with the top on the glass rod and press butt in sand at an angle so that the flow of media reaches just inside the rim of the tube. Tubes can be placed side by side, or use another rod, and alternate from the other side of the

pan. Sand must be packed in between each tube.

7. To avoid over-sterilizing place extra paper behind the tubes and over at least one half of the tubes, then fold first towel over both.

8. Completely cover tubes and paper with additional moist sand, pack tightly, about 1½" deep.

9. Protect autoclave with newspaper to keep free of sand. Place pan on wire rack about 4 inches from the bottom.

10. Sterilize 1 minute at 250 degrees. Close steam valve and let set 30 seconds. Open door valve slowly until all steam is out. Then open door and remove immediately from autoclave. Allow to stand a short time before removing tubes from pan.

The preparation of the sand, placing the tubes in it and sterilizing takes about 1½ hours for 40 tubes. Sterility tests are run frequently incubating over the weekend, or leaving at room temperature for a week. No contamination has ever been noted; the very rare break-down of the media after inoculation can result from other factors occurring with the specimen itself.

In conclusion: The slide culture method was studied for economy in time, materials and efficiency for routine procedure, and found not usable as originally described; another use of the media mentioned was made, with preliminary reports given. Comparison of Petragnani's and Peizer's media was made, followed by a new technique in the simplified formulae and sterilization process of Petragnani's media.

Presented at the California State Society of Medical Technologists. May 3, 1952.

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II. THE EFFECT OF STORAGE ON THE SENSITIVITY OF MODIFIED LÖWENSTEIN MEDIUM

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In 1933 Löwenstein[1] described a medium for the cultivation of the tubercle bacillus, which he stated should not be more than two weeks old when it is used. Holm and Lester,[2] in 1941, advised that a modification of Löwenstein's original medium should be stored at cellar temperature, not exposed to drying or sunshine, and used "fairly soon" after its preparation. In 1951, Corper, Cohn, and James,[3] without giving detail as to actual colony counts, reported that egg yolk medium for the culture of tubercle bacilli could be stored at refrigerator temperature for over one year without appreciable nutrient deterioration.

In consideration of an economic measure for smaller laboratories, it was thought desirable to examine critically the effect of storage on the sensitivity of the modified Löwenstein medium as it is used routinely in the isolation of tubercle bacilli from pathologic materials.

Materials and Methods

The Jensen and Holm modification of Löwenstein medium is prepared as follows:

Salt solution:	
Monopotassium phosphate	2.4 g.
Magnesium sulfate	.24 g.
Magnesium citrate	.6 g.
Asparagine	3.6 g.
Glycerol	12 ml.
Distilled water	600 ml.
Potato flour	30 g.
Homogenized whole eggs	1000 ml.
Malachite green, 2% aqueous solution	20 ml.

The salt solution is heated in a flask in a 56° C. water bath for two hours, or until the salts are dissolved. Thirty grams of potato flour are added to the flask, and the mixture is autoclaved at 121° C. for thirty minutes.

Fresh country eggs, not more than one week old, are employed and are cleaned by vigorous scrubbing in a solution approximating 2.5% soap and 2.5% sodium bicarbonate. They

are then left in the soap and soda solution for thirty minutes, after which time they are placed in cold running water until the water becomes clean. The eggs are broken into a sterile flask, homogenized completely by shaking and filtered through sterile gauze.

One liter of homogenized whole eggs is added to the flask of potato flour-salt solution, which has been cooled to room temperature, and to this is added 20 ml. of a 2% malachite green solution. After thorough mixing, the medium is tubed by means of a sterile aspirator bottle with a bell attachment. Between 5 and 6 ml. of medium are delivered into 150 mm. resistant glass tubes with plastic screw caps. The medium is solidified by inspissation at 85° C. for fifty minutes. The tubes are incubated at 37° C. for forty-eight hours to test for sterility and are then stored in the refrigerator (5° C.) until they are used.

Experiment 1

Four lots of medium were prepared during the year. The ingredients used in the preparation of the media were not necessarily from the same lot. Following incubation for sterility test, the media were stored at 5° C., i.e., refrigerator temperature, for periods of approximately one year, eight months, four months, and two weeks. The one-year-old medium, when originally prepared, was stoppered with cotton and paraffin. After three months storage, approximately one-fourth of the tubes of medium were overgrown with molds. The other three batches of medium were then prepared in 20 x 150 mm. test tubes provided with plastic screw caps. Only an occasional tube of these batches of medium was overgrown with mold after three months or more of storage.

Approximately 4. ml. of sputum, positive for acid-fast bacilli by microscopy, were placed in centrifuge tubes with plastic screw caps and to each tube was added an equal volume of 4% NaOH containing 0.04% phenol red. The tubes were homogenized in a paint conditioner for ten minutes and centrifuged at 3,000 r.p.m. for fifteen minutes. The supernatant fluid was decanted, and the sediments were neutralized with 2N HCl. The concentrates of the NaOH-homogenized sputa were so diluted that from 1 to 100 colonies would be obtained on each tube of the medium. Two tubes of each age medium were inoculated with .1 ml. of the diluted concentrates. Seventy-two specimens received in the routine laboratory were treated and inoculated in the preceding manner. The cultures were incubated at 37° C. and were examined at intervals of two, three, four, five and six weeks. Observations were made as to time of appearance of growth and numbers of colonies.

Results of Experiment 1

Of the seventy-two specimens, sixty-seven were positive on the one-year-old medium, and seventy were positive on the eight months, four months and two-week-old media, respectively, after six weeks incubation. The time of appearance of growth was approximately the same with all the media, as is shown in Table 1.

TABLE I

Effect of Age of Medium on the time of First Appearance of Growth

Time of Appearance of Growth	AGE OF MEDIUM							
	One Year		8 Months		4 Months		2 Weeks	
	No. of Tubes	Percent of Tubes	No. of Tubes	Percent of Tubes	No. of Tubes	Percent of Tubes	No. of Tubes	Percent of Tubes
2 Weeks	11	15.3	12	16.6	8	11.1	13	18.0
3 Weeks	44	61.1	45	62.5	45	62.5	47	65.3
4 Weeks	62	86.1	64	88.8	65	90.3	66	91.7
5 Weeks	66	91.7	70	97.2	69	95.8	69	95.8
6 Weeks	67	93.0	70	97.2	70	97.2	70	97.2
Negative (both tubes)	5	6.9	2	2.8	1	1.4	1	1.4
Contaminated (both tubes)	0	....	0	....	1	1.4	1	1.4

The age of the medium appeared to have little influence on the total number of colonies developing, except in the year-old medium, which appeared less sensitive for small inocula. In the group developing from 1 to 10 colonies per tube, the eight month, four month and two-week-old media, respectively, had an increment in the number of positive tubes corresponding to the decrement of negative tubes as compared with that of the year-old medium. These results are shown in Table 2.

TABLE II

Effect of Age of Medium on Colony Counts

Age of Medium	NUMBER OF TUBES									
	1–10 Colonies	Percent	11–100 Colonies	Percent	101 or More	Percent	Negative	Percent	Contaminated	Percent
1 Year	7	4.9	95	65.9	23	15.9	14	9.7	5	3.5
8 Months	16	11.1	93	64.6	28	19.4	6	4.2	1	0.7
4 Months	15	10.4	92	63.7	26	18.1	5	3.5	6	4.2
2 Weeks	16	11.1	96	66.6	27	18.7	2	1.4	3	2.1

Experiment 2

Thirteen lots of media were prepared during the year. Fresh eggs were used for each batch of medium, but the other ingredients were all from the same original lots. Plastic screw cap tubes (20 x 150 mm.) were used. After incubating the media at

37° C. for twenty-four hours, they were stored at 5° C.

Microscopically positive sputum was diluted with microscopically negative sputum specimens and the mixture was shaken ten minutes in a paint conditioner. Smears were made, stained by the Ziehl-Neelsen technique, and examined microscopically. Additional microscopically negative sputum was added to the pooled sputum, and the process repeated until only three acid-fast bacilli were seen during examination of three lengths of the smear. Approximately 4 ml. of the sputum was added to each of 20 centrifuge tubes. Digestion, concentration, and neutralization were performed essentially as described above. The sediments were pooled and 20 tubes of each lot of medium were inoculated with .1 ml. of this material. In this experiment, only 8 tubes of the medium which had been stored for one year were inoculated, since all of the others were contaminated with molds. The tubes were inoculated alternately, i.e., one tube of every lot was inoculated before inoculating the second tube of any lot. They were then slanted and incubated at 37° C. The colonies were counted at weekly intervals after the third week of incubation until they were six weeks old.

Results of Experiment 2

The contamination on the tubes of media after storage at 37° C. for 48 hours was bacterial. After storage at 5° C. for varying lengths of time (Column 1, Table 3) the contamination was caused entirely by molds.

TABLE III

Effect of Age of Medium on Rate of Contamination

Age of Medium	Number of Tubes	Tubes Contaminated Upon Initial Incubation for 48 Hours at 37° C and Before Storage at 5° C	Tubes Found to be Contaminated After Storage at 5° C
1 Year	327	0	319
11 Months	317	1	296
10 Months	298	0	214
9 Months	295	0	136
8 Months	286	0	107
7 Months	281	0	258
5 Months	283	0	250
3 Months	279	1	47
2 Months	334	2	15
6 Weeks	276	1	7
4 Weeks	263	0	0
2 Weeks	224	0	0
1 Week	239	0	0

The geometric means of the colony counts (Table 4) indicate that the age of the medium has no relation to the number of colonies that develop. There is evidence from these results that one may obtain as high colony counts on medium up to eleven months old as on fresh medium. With one-year-old medium, zero

TABLE IV

Effect of Age of Medium on Geometric Mean of Colony Counts

Age of Medium	Geometric Mean of Colony Count
1 Year	8
11 Months	104
10 Months	114
9 Months	107
8 Months	80.5
7 Months	112
5 Months	114.5
3 Months	114.5
2 Months	111.5
6 Weeks	113
4 Weeks	108
2 Weeks	118.5
1 Week	109

colony counts were as frequent as high colony counts. The significance of this result is doubtful in light of the fact that only 8 tubes were inoculated. Since one-year-old medium gives unusually low colony counts, and since 319 of the 327 tubes of the one-year-old medium were contaminated by mold when stored at 5° C., the use of fresher medium is preferred.

Discussion

The results from the two experiments indicate that storage of the modified Löwenstein medium at 5° C. has no apparent effect on the time of appearance of growth, or on the number of colonies, except for that medium which is stored for one year. It is interesting to note that this finding on the effect of storage on the sensitivity of media is in marked contrast to results of a study from this laboratory concerned with the effect of storage (5° C.) of eggs on the sensitivity of the modified Löwenstein medium.[4] It was found that the use of other than relatively fresh eggs, i.e., more than two or three day old, in the preparation of the medium, results in a statistically significant reduction in the sensitivity of the medium. From the practical standpoint, perhaps the greatest disadvantage to the storage of medium for relatively long periods of time, even at refrigerator temperature, is the loss, of rather large numbers of tubes through contamination with mold. The media that were stored for five and seven months were prepared during the summer months when the contamination of the air was probably high.

Summary

Storage of modified Löwenstein medium at refrigerator temperature, i.e., 5° C., for as long as eleven months has no appreciable effect on the time of appearance of growth, or on the

number of typical colonies of *Mycobacterium tuberculosis*. Therefore, it would appear feasible for smaller laboratories to prepare and store Löwenstein's medium in quantities sufficient for several month's supply. The only disadvantage to storage of the medium for as long as eleven months is the high rate of contamination by molds.

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III. A COMPARISON OF PEIZER'S MEDIUM WITH MODIFIED LÖWENSTEIN'S MEDIUM FOR THE PRIMARY ISOLATION OF TUBERCLE BACILLI FROM SPUTUM

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INTRODUCTION

The ideal culture medium for the primary isolation of *Mycobacterium tuberculosis* from pathological material should possess the following characteristics: (a) ability to support growth of all of the viable tubercle bacilli present in the inoculum; (b) ability to produce early appearance of growth; (c) differentiation of the various types of mycobacteria by colonial characteristics; (d) suppression of the growth of commensal organisms without inhibiting tubercle bacilli; and (e) simple preparation.

To date the ideal culture medium has not been found, but the search continues. Peizer and Schecter[1] recently described a new agar medium for the primary isolation of *M. tuberculosis*. It is claimed that, in general, growth is more profuse and appears earlier on the agar medium than on the Jensen modification of Löwenstein's medium.[2]

The following study is a comparison of Peizer's medium (enrich-

ment A) with the Jensen-Holm modification[3] of Löwenstein's medium for the primary isolation of tubercle bacilli from sputum.

Materials and Methods

Media: The culture media were prepared as closely as possible following the directions given with the formulas.

Modified Löwenstein Medium (Jensen-Holm).

Salt Solution:	
Monopotassium phosphate	2.4 gm.
Magnesium phosphate $.7H_2O$	0.24 gm.
Magnesium citrate	0.6 gm.
Asparagine	3.6 gm.
Glycerine	12 ml.
Distilled Water	600 ml.
Potato Flour	30 gm.
Homogenized whole eggs	1000 ml.
Malachite green, 2 per cent aqueous solution	20 ml.

The medium was tubed under aseptic conditions and inspissated at 85° C. for 50 minutes.

Peizer Medium.

Base agar:	
Beef extract (Bacto)	3 gm.
Casein hydrolysate (Cassamino acids-Difco)	10 gm.
Potato starch	15 gm.
Asparagine (Bacto)	3 gm.
Dipotassium phosphate	3.5 gm.
Ferric ammonium citrate	0.1 gm.
Citric acid	0.1 gm.
Magnesium sulfate	0.015 gm.
Agar (Bacto)	15 gm.
Distilled water	1000 ml.
Enrichment A:	
Egg yolks	10
Saline (sterile)	25 ml.
Glycerine (sterile)	40 ml.
Malachite green, sterile 1% aqueous solution	13 ml.
Dextrose, sterile 20% aqueous solution	1 ml.

The agar base was sterilized in the autoclave for 10 minutes at 115° C. The enrichment mixture was added to the cooled agar base (50°-55° C.) and tubed with aseptic precautions.

Techniques: Unselected, routine samples of sputum were placed in sterile screw capped centrifuge tubes to which an equal volume of 4 per cent sodium hydroxide, containing 0.004 per cent phenol red as a pH indicator was added. The tubes were shaken for 10 minutes in a paint conditioning machine followed by centrifugation at 3,000 r.p.m. for 15 minutes. The supernatant fluid was discarded and the sediment was neutralized with 2N HCl. Sterile graduated

1 ml. pipettes were employed to inoculate 0.1 ml. of sediment from each specimen onto each of two tubes of Peizer's medium and two tubes of modified Löwenstein's medium. The cultures were incubated at 37°C. and were examined at weekly intervals. The time of first appearance of growth, number of colonies, colonial morphology and number of tubes contaminated were recorded for each medium. All positive cultures were confirmed by staining growth from the colonies with the Ziehl-Neelsen stain. All atypical cultures were inoculated into animals for confirmation of type.

Results

Table I reveals that of a total of 1,585 specimens of sputum examined there were 159 positive specimens, 120 contaminated (unsatisfactory) specimens and 1,306 negative specimens.

TABLE I
General Analysis of Specimens (Sputum)

Total number of specimens	1,585
Total number of positive specimens	159
Total number of contaminated specimens†	120
Total number of negative specimens	1,306

† At least three of four tubes on each specimen contaminated.

In Table II it is seen that 66 per cent of the positive specimens showed growth on both media; 20.1 per cent were positive on Löwenstein's and negative on Peizer's medium; and 13.8 per cent were positive on Peizer's and negative on Löwenstein's medium. The total number of specimens positive on Löwenstein's medium was 137 (86.1 per cent) whereas the total number of specimens positive on Peizer's medium was 127 (79.8 per cent).

TABLE II
Comparison of Incidence of Growth on Modified Lowenstein Medium and Peizer Medium

A. Positive Specimens Detected on the Two Media

	Number of Specimens	Percent of Total Positives
Positive on Lowenstein, Positive on Peizer	105	66.0
Positive on Lowenstein, Negative on Peizer	32	20.1
Negative on Lowenstein, Positive on Peizer	22	13.8
Total Number of Specimens Positive on Lowenstein	137	86.1
Total Number of Specimens Positive on Peizer	127	79.8

B. Number of Colonies Detected on the Two Media

Number of Colonies (Total Both Tubes)	LOWENSTEIN		PEIZER	
	Number of Specimens	Percent	Number of Specimens	Percent
1— 9	54	39.4	57	44.8
10— 25	18	13.1	29	22.8
26— 50	25	18.2	14	11.0
51—100	40	29.2	27	21.2

Average number of colonies per positive specimen on Lowenstein	36.5
Average number of colonies per positive specimen on Peizer	27.6

The average number of colonies per positive specimen was 36.5 on Löwenstein's and 27.6 on Peizer's medium. Likewise, 47.4 per cent of the specimens positive on Löwenstein's medium had colony counts greater than 25 colonies while only 32.2 per cent of the specimens positive on Peizer's medium had colony counts greater than 25 colonies.

The comparison of rapidity of growth on the two media (Table III) shows that 33.7 per cent of the positive cultures on Peizer's medium had appeared by 21 days, while only 23.3 per cent of the positive Löwenstein cultures had appeared by 21 days. The average number of days until first appearance of growth was 25.5 days on Peizer's medium and 27.3 days on Löwenstein's medium. The average number of days until first appearance of growth on Löwenstein's medium is greater in this study than in a previous study by Melvin, et al[4] in which the average number of days until first appearance of growth on Löwenstein's medium did not exceed 23.1 days.

TABLE III

Comparison of Rapidity of Growth on Modified Lowenstein Medium and Peizer Medium

Time of First Appearance (in days)	Lowenstein Medium		Peizer Medium	
	Number of Specimens	Percent	Number of Specimens	Percent
7—14	1	0.7	1	0.7
15—21	31	22.6	42	33.0
22—28	58	42.3	53	41.7
29—35	31	22.6	21	16.5
36—42	10	7.3	9	7.0
42	6	4.3	1	0.7
Average number of days, first appearance on Lowenstein				27.3
Average number of days, first appearance on Peizer				25.5

The incidence of contamination, as shown in Table IV was higher on Löwenstein's medium than on Peizer's medium. As mentioned in Table IV, a tube was considered contaminated when one-half or more of the surface of the slant was covered by growth of the contaminant.

TABLE IV

Comparison of Contamination* on Modified Lowenstein Medium and Peizer Medium

		Percent of Total No. of Tubes
Total number of tubes in study	3,170	100
Number of tubes of Lowenstein contaminated	558	17.6
Number of tubes of Peizer contaminated	396	12.4

* One-half or more of surface of slant covered by contaminating microorganism.

Discussion

The differences in the incidence of positive specimens, average number of colonies per positive specimen, and incidence of contamination on the two media are not statistically significant when tested by the chi-squared method* devised by McNemar[5] for paired samples.

There was a marked difference in the size of the colonies on the two media. The diameter of the colonies on Peizer's medium was usually about twice the diameter of the colonies on Löwenstein's medium.

Stock cultures as well as wild strains of saprophytic mycobacteria were inoculated on the two media and in some instances differentiation based on colonial morphology was difficult on Peizer's medium because of the similarity of colonial characteristics on this medium. On Peizer's medium, some of the slow growing non-chromogenic saprophytic mycobacteria resembled human type colonies of *M. tuberculosis*. A stock strain (Copenhagen) of bovine type *M. tuberculosis* exhibited eugonic colonies on Peizer's medium and dysgonic colonies on Löwenstein's medium.

An advantage of Peizer's medium is that it does not require inspissation, thereby the need for special equipment is eliminated; also the agar base may be prepared in advance and stored until needed when it is melted and the enrichment mixture added. Thus a busy laboratory can budget the time spent on media preparation; this is rather difficult with coagulated egg media since it must be prepared *in toto*.

Summary

The incidence of positive specimens and the average number of colonies per positive specimen was slightly greater on Löwenstein's than on Peizer's medium whereas the average time for appearance of growth was slightly earlier on Peizer's than on Löwenstein's medium. Although the number of colonies was usually greater on Löwenstein's medium the size of the colonies was usually greater on Peizer's medium. Differentiation of types of mycobacteria based on colonial characteristics was not as clear-cut with Peizer's as with Löwenstein's medium.

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* $X^2 = \frac{(A - D)^2}{A + D}$

ACKNOWLEDGMENT

We are indebted to Dr. Robert Serfling and Mr. Myron Willis, Communicable Disease Center, for subjecting the data obtained in this study to significance tests.

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Medical Technologists

OPEN HOUSE

During Hospital Week: May 10-16, 1953

YOUR SPECTROPHOTOMETER MUST BE SET UP IN EXACT HORIZONTAL POSITION

Among the "little things that count" is the accurate setting up of the spectrophotometer. When we work with any laboratory instrument, we assume that it is performing accurately. Is it? Always?

Let us examine the mechanical properties of the spectrophotometer. In this article we are mainly concerned with the galvanometer, a jewel precision instrument that is subject to many conditions, among which is a vertical positioning with a horizontal relationship to the instrument itself.

The galvanometer needle mirror is suspended between two gold foil strips; if the galvanometer is not in correct vertical position, the center of gravity is lowered. In such case it will require more light intensity to activate the photocell to bring the galvanometer up to the proper position, and our results will be increased or decreased because in the absorption spectrum light is not increased or decreased by vertical positioning.

Through a series of tests we have found that 1 mm. variation off the horizontal plane will cause our transmittance plane to be at least 10 units off on either side of our readings. To do precision work with precision instruments we must attain a high degree of accuracy. We cannot assume our laboratory tables are all on a true horizontal plane, so to correct our machine we must first find if our machine is exactly level. (An ordinary tube of water with an air bubble may be used as a "level.")

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CLINICAL CHEMISTRY—PRACTICAL POINTS*

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This paper deals with several features related to clinical chemistries. They are not too well connected but are treated together because of the practical relationship to medical technology. The first of these is an understanding of and an appreciation for the use of milliequivalents as a unit for expressing quantities in chemical analyses; the second is the problem of uniformity in choosing the fraction of blood to be used for chemical analyses; the third the nature of the chemical analyses to which smaller laboratories should be limited; and lastly the packaging of specimens for chemical analyses to reach other centers through the mail.

As to an understanding of and an appreciation for the use of milliequivalents as a unit for expressing quantities in chemical analyses, the strongest argument for its adoption rests in the words of Claude Bernard, "the stability of the liquid part of the blood." "Chemical composition," the expression popular by common usage is synonymous with "stability" but it does not connote the necessity of seeing every component in the blood stream in relationship to the other components found there. The word "stability" makes this connotation. The very existence of the organism is dependent not so much on what goes on outside him as what goes on within him—not so much on his external environment as on the elementary exchanges in the liquid part of the blood (and the nutrition) surrounding and bathing the tissue elements, chiefly the cells. All this Claude Bernard says in these words:

> "The living organism does not really exist in milieu exterieur . . . but in the liquid milieu interieur formed by the circulating organic liquid which surrounds and bathes all the tissue elements; this is the lymph or plasma, the liquid part of the blood which . . . is diffused through the tissues and forms the ensemble of the intercellular liquids and is the basis of all local nutrition and the common factor of all elementary exchanges.
>
> "The stability of [this liquid] is the primary condition for freedom and independence of existence. . . ."

To give a picture of this stability, this chemical structure or anatomy, the chemical composition can no longer be described in masses per cubic centimeters. Hitherto the custom was to convert results of analyses, no matter what the technique—

* Paper prepared for Continuation Course in Clinical Chemistry, Oct. 7, 8, 1952, University of Minnesota, Center of Continuation Study, Minneapolis. Permission to publish confirmed by Sister M. Alcuin.

titrimetry, colorimetry or gravimetric analyses into "mg%" or "g%." In using these terms the relative magnitude and the interrelationship of the components were not displayed, i.e., the results did not give an idea of what number or how the particles were involved. This is the crux for the argument for changing from the present practice of looking at a mass in a hundred cubic centimeters to adopting milliequivalents (and related denominations).

Chemical reactions whether in vivo or in vitro, whether in the living animal or in the test tube are reactions consistently between particles, whether one for one or in multiple proportions; they are not between arbitrarily established masses. Any disarrangement of the number of particles or the nature of one type of particle is reflected in the number and nature of the remaining particles. This inter-relationship is, in part, what is meant by the stability of the liquid or body fluid.

The part the medical technologist plays in clinical chemistry is to show medical men that the chemical structure of the extracellular fluid is retaining proper stability by analyzing quantitatively chemically the most accessible portion and that is the blood, either whole, or either fluid component, plasma or serum. This chemical analysis of blood had been a standard practice even before 1915, but the tendency now is to depart from the former way of expressing the analysis quantitatively to put emphasis on, not masses, but on quantities in terms of relative magnitudes or numbers of particles, that is, on adopting milliequivalents. In other words, the tendency is to put the emphasis on a practice that will make it possible to obtain, for instance the total base, by reducing each single component of the blood to terms that have a common denominator.

This brings the discussion to a consideration of the particles, their nature, their number and their unit of measurement from the angle of structure or stability of the body fluid. Throughout this paper a privilege is being taken of referring from time to time to all the particles in the body fluid collectively as "metabolites," disregarding the correct sense of the term. "Metabolites" in the correct sense of the word refers to ions, molecules, and colloidal particles which result from normal or disturbed metabolism, i.e., from the normal or abnormal chemical and physical reactions building up or reconstructing the body. But as used in this paper the term "metabolites" is extended to include also those substances present because of impairment of a regulatory mechanism such as kidney damage or pathology in another regulatory organ. Nutrients such as glucose are also included in the term.

Metabolites are either electrolytes such as the mineral salts, sodium chloride and calcium chloride, and characterized by dis-

sociation into ions in solution; or, non-electrolytes such as proteins or other complex carbon compounds whose dissociation into ions is insignificant. Before these metabolites are able to function, they must be in solution, true or colloidal. The electrolytes are likely to form true solutions, the complex proteins and lipides are likely to form colloidal solutions.

Now for the inter-relationship of these particles. An equivalent or chemical equivalence refers to the mass of metabolite that has a combining power or displacing power of some quantity of a standard element. This standard and its quantity is 1.008 g. hydrogen (or 8.0 g. oxygen). Thus the mass displacing that weight of hydrogen of the metabolite weighed in grams is a gram equivalent weight, and if dissolved in water to make a liter of solution is an equivalent per liter or a normal solution and labeled "N." The "N" could nicely stand for number of particles because Avogadro proved (and other scientists have confirmed his finding) that every gram equivalent weight of a substance contains 602300000000000000000000 (or 6.023×10^{23}) number of particles. A normal (N) solution then has N number particles per liter. In the realm of the non-electrolytes a normal solution may be a gram molecular weight per liter, or to illustrate with glucose, 180 g. per liter. This is an N solution in the sense of numbers. Sulphuric acid, to illustrate a bivalent element, would be 98/2 g. per liter because in ionizing, it gives rise to twice the number of equivalents of 1.008 g. hydrogen; therefore the doubling is controlled by cutting the mass in half. Saying it once more, these masses per liter are gram equivalents per liter, or equivalents per liter, or normal solutions, or, and this independent of volume, are equivalent or identical number of particles.

With body fluids the mass of metabolite is so much less than the masses described above, that instead of dealing with grams it becomes far more satisfactory from the angle of arithmetic to deal with 1/1000 of a gram or milligram. The quantities thus reduced to 1/1000 of the value give rise to the expression milligram equivalent weight per liter, or milliequivalents per liter, or independent of volume as milliequivalents, designated as "mEq."

An understanding of milliequivalents is gotten from a brief consideration of this equation which pertains to the metabolites commonly identified in blood plasma:

$$\underset{142}{Na^+} + \underset{5}{K^+} + \underset{5}{Ca^{++}} + \underset{3}{Mg^{++}} \rightarrow \underset{103}{Cl^-} + \underset{27}{HCO_3^-} + \underset{2}{HPO_4^{=}} + \underset{1}{SO_4^{=}}$$

$$+ \underset{6}{\text{organic acid}} + \underset{16}{\text{protein}}$$

Interpreting this equation, the meaning is that in 1000 cc. blood plasma there are 142 mEq sodium ion, 5 mEq potassium

ion, 5 mEq calcium ion, 3 mEq magnesium ion, 103 mEq chloride ion, 27 mEq bicarbonate ion, 2 mEq biphosphate ion, 1 mEq sulphate ion, 6 mEq organic acid radicals and 16 mEq protein particles. In other words, the numerical values represent the mEq of each metabolite. But these values in the sense already discussed mean relative numbers of particles as well. For example, for 142 sodium ions there are 5 potassium ions or 103 chloride ions, and so on. The equation gives the possibilities of salt formation in the plasma. For instance sodium cannot exist wholly as a chloride because there are lacking the difference between 142 and 103 or 39 chloride ions. Therefore sodium must exist as other salts, and the next most concentrated is the bicarbonate. Because the sodium as bicarbonate is nonvolatile and therefore fixed as a base or reserved to the plasma, that measure of sodium as the bicarbonate salt is called the "alkali reserve." This entity will be discussed later in relation to buffering.

Considering the acid radicals, and putting the emphasis on an analysis for chlorides, common usage expresses this concentration as NaCl. From the equation it is apparent that there can be only 103 mEq of NaCl. The equation explains why, on the other hand, sodium analyses are never made in terms of NaCl. It bears repetition to say that the quantities under guise of mEq are quantities formerly recorded as "mg%" or masses per 100 cc. sample. The analysis for the substances remains the same whether expressed as "mg%" for instance, or "mEq." The treatment of the readings of the photelometer, visual colorimeter or whatever other instrument is used in the technique is different, i.e., the calculations following the analysis are different. A few examples will illustrate this.

According to the equation 142 mEq of sodium ions exist in a liter of plasma. But 1 mEq is 23 mg. per liter. Then 142 mEq/l equals 142×23 mg. or 3266 mg. per 1000 cc. or, on the old basis of 100 cc., 326.6 mg. per 100 cc. or 326.6 mg. %. Potassium concentration lends itself to a similar pattern of calculation. Interpreting 5 mEq of calcium ions, calcium has an atomic weight of 40 but its valence is 2, so 40/2 or 20 is the equivalent weight. Recalling mEq as milligrams then 5 mEq equals 5 x 20 mg. or 100 mg. per 1000 cc. or 10 mg. per 100 cc. or 10 mg. %. Were the calculations made for each of the other metabolites we would derive these values, more familiar because older in usage: (All values are averages). Sodium 335 mg. %; potassium 19 mg. %, calcium 10 mg. %, chlorides as NaCl 590 mg. %, phosphorus 4.5 mg. % protein 8 %, CO_2 C.P. 60 vol. %, etc.

Phosphates in the extracellular fluid are in the form of sodium salts and briefly this is the fact about them: Na_2HPO_4 is 4 times more concentrated than NaH_2PO_4 which means the disodium

form is 0.8 and the monosodium 0.2 the total phosphate concentration. To surmount what appears to be a hurdle in the calculation, the following is the commonly accepted practice: divide the mg. phosphorus by 1.8. The explanation is this: The medical technologist is analyzing for inorganic phosphorus or P, and the mg. he attains in his calculations is this P. To recognize the distribution as acidphosphate ($HPO_4^=$) and diacidphosphate ($H_2PO_4^-$) radicals, he has to partition this P between divalent and monovalent entities in the ratio of 0.8 to 0.2, the divalent requires 2×0.8, so the valency is accepted as $(2 \times 0.8) + 0.2$ or 1.8. To summarize:

$$\frac{Na_2HPO_4}{NaH_2PO_4} = \frac{0.8}{0.2}$$

or

$$\frac{HPO_4^=}{H_2PO_4^-} = \frac{2 \times 0.8}{1 \times 0.2} \text{ or } 1.6 + 0.2 \text{ or } 1.8$$

The equivalence is distributed, in other words, as the above ratio indicates, the bivalent salt : monovalent : : (2×0.8) : 0.2 and therefore 1.6 + 0.2 or 1.8.

For HCO_3^-, the distribution of carbonic acid and its salt, for the greater part the sodium, or sodium bicarbonate is expressed as volumes per cent in the well-known van Slyke gas analysis for CO_2. The easiest way to translate from that quantitative expression to milliequivalents is to have recourse to the law that a gram equivalent weight of the metabolite in the gaseous condition under standard conditions of pressure and temperature occupies 22.4 liters, and since CO_2 C.P. is expressed per 100 cc. in the older method, the volume would be 1/10 of that gram molecular volume or 2.2+ and mEq become

$$\frac{CO_2CP \text{ vol. } \%}{2.2+} = \text{mEq}$$ The answer then is the base equivalence.

Owing to its multivalence the base equivalence of protein is about 8 times its concentration value, so the conversion is made by use of the van Slyke factor of 2.43, the equation being

$$2.43 \times \text{g/100 cc.} = \text{mEq}$$

The summary below applies to the statements above and concludes the discussion as pertains to an understanding of the term "milliequivalent."

Summary: **Mg/100 cc changed to mEq:**

Sodium 335 mg %
Potassium 19 mg %
Calcium 10 mg %
Chlorides (as NaCl) 590 mg %
Phosphorus 4.5 mg %

$(BHCO_3)$ CO_2C.P. 60 vol. %
$H.HCO_3$ 3 vol. %
Protein 8 %

Na^+: $\frac{mg/100\ cc \times 10}{23}$ Cl^-: $\frac{mg/100\ cc \times 10}{35}$

K^+: $\frac{mg/100\ cc \times 10}{39}$ $HOP_4^{=}$: $\frac{mgP/100\ cc \times 10}{31} \times 1.8$

Ca^{++}: $\frac{mg/100\ cc \times 10}{40} \times 2$ $SO_4^{=}$: $\frac{mgS/100\ cc \times 10}{32} \times 2$

Mg^+: $\frac{mg/100\ cc \times 10}{24} \times 2$

Now to get an appreciation of the term "milliequivalent" Figure 1 has been drawn to show milliequivalents as the instrument for expressing inter-relationship of ions or the chemical structure in plasma. The concentration is expressed per liter plasma not plasma water. (Plasma water necessitates at least an approximation or a determination of specific gravity to correct for the nitrogenous constituents, especially the proteins.)

Thus Figure 1 gives the normal concentrations in blood plasma in terms of the positive ions or cations or potentially basic substances on the left, and the negative ions or anions or potentially acidic substances on the right. On the outer side of the ordinate are the milliequivalents per liter of each constituent. The concentrations of organic acid radicals have been calculated, not determined experimentally, by taking them as the difference between the sum of the other anions and the total base. Putting a line of demarcation between the basic constituents and acidic constituents means that in plasma the clinician is dealing with separately controlled ions, not salts. Carbonic acid will be shown later to be an exception to this statement.

From Figure 1, by expressing in milliequivalents per liter, a description is got not only of the ionic population of blood plasma but also of the relationship of the population, i.e., an idea of chemical equivalence. In examining the figure it becomes evident that

1) 90 per cent of the total ionic concentration are represented by univalent ions, namely Na, K, Cl, HCO_3 ions $(142 + 5 + 27 + 103 = 277: 277/310 = 0.90$

and 2) About 95 per cent of the blood metabolites are the positive sodium, potassium, calcium, magnesium ions and their acid counterparts, the bicarbonates and chlorides.

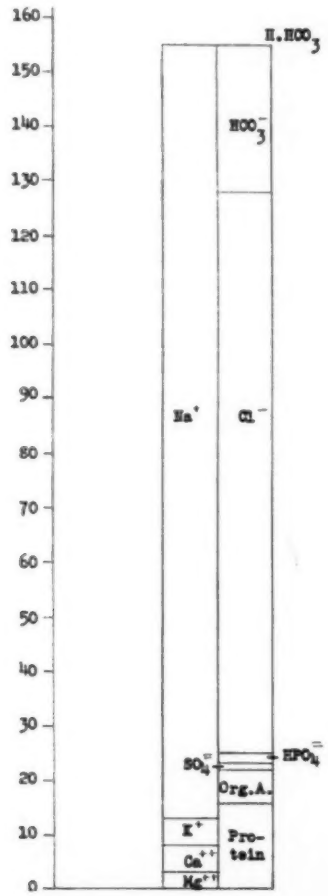
These six are really the traffic officers responsible for what goes on in the body. Were the sulphates and phosphates included, the application is virtually an acid-base balance of 4 cations and

4 anions. Sodium ions are by far the most numerous and hence are responsible for most of the basic element in plasma; chloride ions are the next greatest in concentration and represent the greatest acid element of the plasma but the bicarbonates, though lesser in concentration, are acid elements capable of buffering.

Fig. 1. COMPONENTS OF BLOOD PLASMA AS MILLIEQUIVALENTS PER LITER

BASE	mEq/l
Na^+	142
K^+	5
Ca^{++}	5
Mg^{++}	3
	155

ACID	mEq/l
HCO_3^-	27
Cl^-	103
$HPO_4^=$	2
$SO_4^=$	1
Org. A.	6
Protein	16
	155



Incidentally, carbonic acid is under respiratory control, plasma proteins under a mechanism not fully identified, and all the other metabolites under renal control. These facts are mentioned merely to stimulate the thinking along lines which lift the chemist from the role of an isolationist to one capable of envisioning in his chemical analyses many mechanisms responsible for the metabolite under study.

The normals charted above are subject to slight oscillations due to fluid exchange, particularly water, and to the time interval necessary for the pacemaker, the kidney, to get rid of water and extra fluids. In disease large deviations may develop.

Another appreciation of the term "milliequivalent" follows from consideration of the phenomenon of buffering. Buffering means a control of pH. Buffering is the substitution of a weakly acid substance for a strongly acid substance; or the substitution of a weakly basic for a strongly basic substance. Illustrations of buffering are given very simply in these two equations:

$$HCl + NaHCO_3 \longrightarrow NaCl + H_2CO_3 \qquad (1)$$

$$NaOH + H_2CO_3 \longrightarrow H_2O + NaHCO_3 \qquad (2)$$

These two equations are simplified statements of the fact that through the medium of water, and man is a watery animal, hydrogen ions and hydroxyl ions arise potentially (and their balance in the blood stream is expressed in pH units). The buffering process occurs in equation 1 at the expense of alkali reserve ($NaHCO_3$), and vice versa, in equation 2, at the expense of carbonic acid (H_2CO_3).

The simplest routine measure of buffering is the test made by the van Slyke burette and known as the CO_2C.P. (carbon dioxide combining power). Normally this averages 60 vol.% and represents the $NaHCO_3$, or alkali reserve. The carbonic acid, measured otherwise, H_2CO_3, is 3 vol. %. Again these expressions are less suited for their purpose than their values as milliequivalents, 27 mEq and 1.3 mEq per liter respectively. In the Hasselbalch-Henderson equation, equation 3 below, they become the numerator and denominator respectively of the fraction written there:

$$pH = \log_{10} pK + \log_{10} \frac{NaHCO_3}{HHCO_3} \qquad (3)$$

When this equation is interpreted, it is evident that in order to buffer the blood within the normal span of pH 7.34 to pH 7.43, the ratio of the $NaHCO_3$ and $HHCO_3$ must be preserved for this ratio indirectly measures the pH and is independent then of the absolute values of either metabolite. Incidentally, merely performing a "van Slyke" test is leaving the practitioner to the

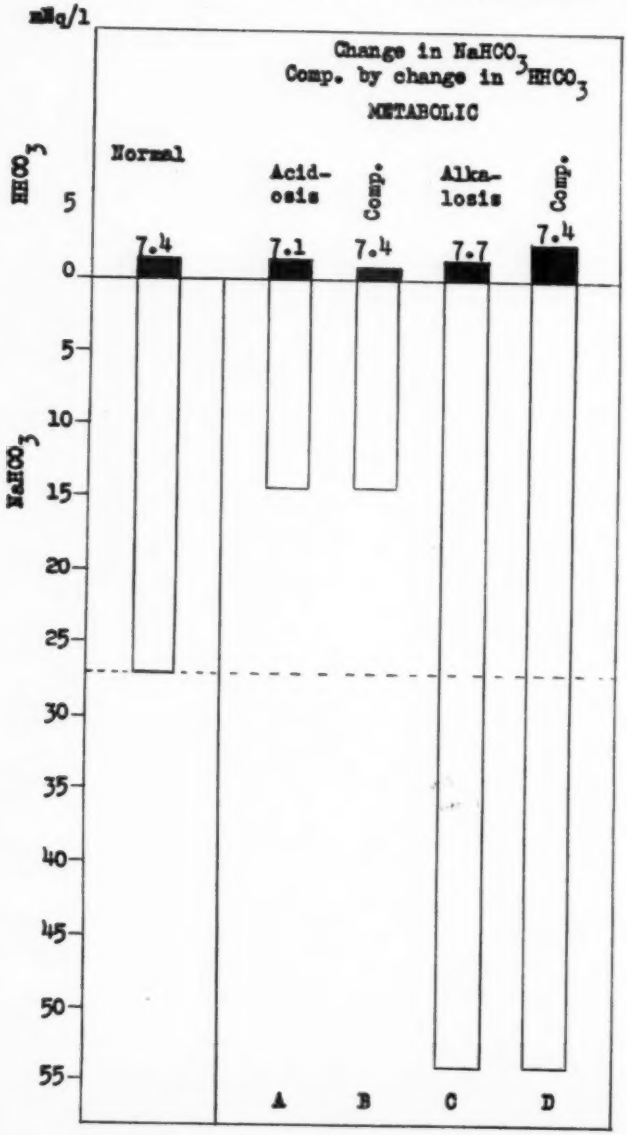
mercy of his clinical findings. He has the numerator but not the denominator of the fraction in equation 3. He has not enough laboratory data to warrant a diagnosis of acidosis or alkalosis, compensated or uncompensated.

Since the concentration of carbonic acid is governed by the respiratory mechanism, an abnormal value for $HHCO_3$ is a respiratory alkalosis or acidosis. Compensation is effected by changes in $NaHCO_3$. But these respiratory changes are infrequent and mentioned here merely to define. The usual cause for alteration of the alkali reserve carbonic acid ratio is secondary to changes in other parts of the ionic structure of the plasma. This means that in case of compensation an unimpaired mechanism of control compensates for a disabled mechanism of control. The integrity of the ionic structure depends on the HCO_3^- and this in turn on the availability of base. The next figure, Figure 2, shows a normal pattern and some possible alterations. Figure 2 shows the normal 27 mEq/l of $NaHCO_3$ and (60 vol. %) and 1.3 mEq (3 vol. %) $HHCO_3$. In the section labelled "Normal" the pH is indicated as 7.4. In the section to the right a metabolic acidosis is indicated by a disturbance of the ratio of the alkali reserve to the acid, caused by a decrease of the bicarbonate to half its original value. Compensation for reduction of $NaHCO_3$ is made by lowering $HHCO_3$ to half its original value. Column A and Column B respectively show this acidosis and its compensation to restore the pH to the original 7.4. Now by doubling the $NaHCO_3$ as Column C indicates, an alkalosis of 7.7 is provoked and by compensating by a doubling of $HHCO_3$ the pH is restored to the original 7.4.

Though the figure is ideal in that complete compensation is indicated, compensatory mechanisms fall short of the mark, and the departure of pH from 7.4 is not prevented but it is greatly limited. Obviously both measurements, the pH of the plasma and the van Slyke, are necessary to describe the direction of the reaction change and the degree of compensation.

To carry the study along to include the other parts of the acid-base structure of the plasma, Figure 3 is offered. This represents the adjustment of the bicarbonate from normal to conditions of acidosis and alkalosis with concomitant changes in the ionic pattern of the plasma. The carbonic acid governed by the respiratory mechanism is placed at the top of each column. The column marked "A" represents the anions shown in Figure 2 and the column marked "B" the cations. How much base of the alkali reserve will remain available to the bicarbonate ion depends wholly on the nature and number of other metabolites. It follows that any change in the acidic ion pattern will cause a corresponding change in the $NaHCO_3$. How these will

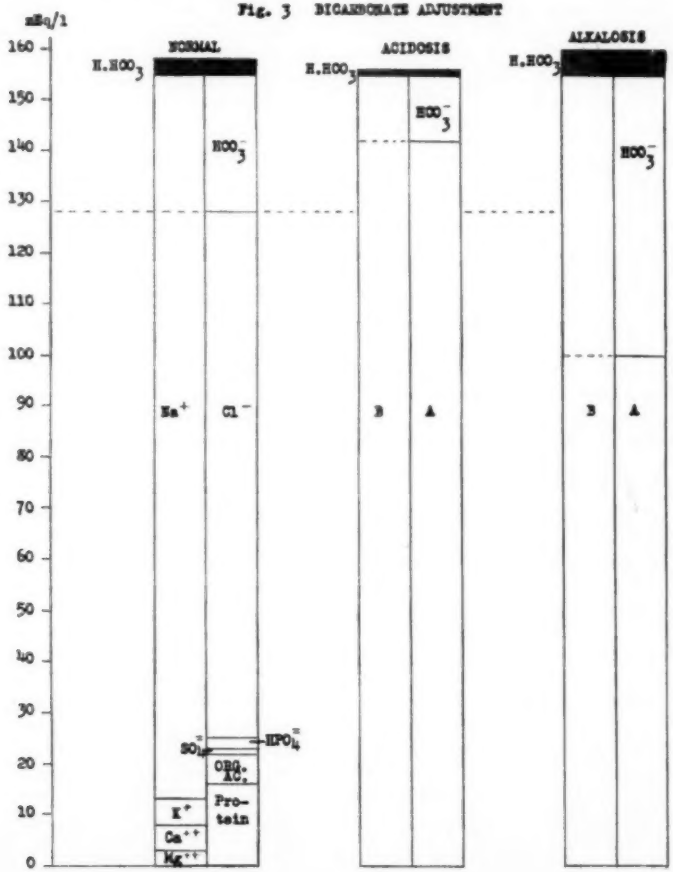
Fig. 2. METABOLIC ALTERATION AND pH



be altered depends in part on the kidney for exclusive of protein the other metabolites are under renal control as stated earlier. This is recalled now merely to provoke some thinking as to what might cause alterations in the ionic pattern of the plasma other than metabolic processes.

In the figure the acidosis section represents the sum of other anions (A) increased above normal. This means that the bicarbonate ion (HCO_3^-) is dispossessed of a corresponding mEq of base. (The decrease in the HCO_3^- ion is by way of respiration.) In the figure the alkalosis section represents a decrease

Fig. 3 BICARBONATE ADJUSTMENT



in the other anions by a corresponding increase in HCO_3^-, the sodium and other plasma basic ions being reduced at the expense of the $NaHCO_3$. All have been expressed in terms of milliequivalent ionic population, not volumes.

So by means of mEq it becomes possible to appreciate the reasons for the stability of the pH of the blood, and to observe the regulatory mechanisms that bring about a compensation in case of an acidosis or an alkalosis, so that fixed values for alkali reserve and $HHCO_3$ need not be maintained. The changes in the quantity of bicarbonate featuring in these buffering processes and the inter-relationship of these quantities to the other quantities in the integral ionic pattern would never be as meaningful nor as effectively expressed by use of the van Slyke volumes per cent as by use of milliequivalents per liter. This alone seems a sufficient argument for adopting milliequivalents as a quantitative expression in reporting clinical chemical analyses.

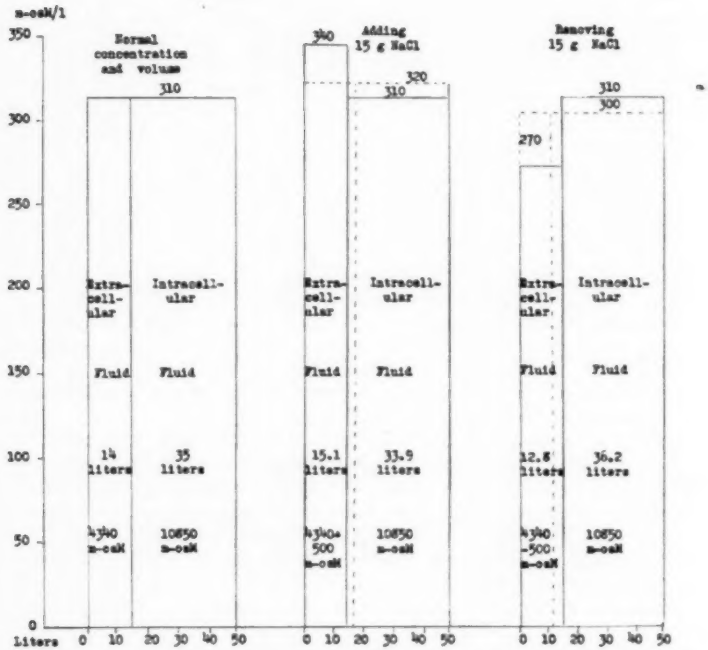
But another feature is brought to the fore in the use of milliequivalents and that is volume changes. Not only does the solute but also the solvent become a part of the picture, yet in the mass per 100 cc manner of quantitatively expressing metabolites, the chemist loses sight of this other component. The solvent or the fluid part of the blood has a direct relationship to the water balance. The water balance is no small matter in sustaining life. Water balance in itself can become a lengthy discussion but in this paper it will be limited to changes in volume of extracellular fluids. It will not dwell on such facts as 5 per cent of the body weight is blood plasma, 15 per cent extracellular fluid (interstitial fluid), and 50 per cent intracellular fluid. Neither will it discuss the insignificant degree of disturbance of proper physiology by extensive volume changes of interstitial fluid, nor the controlling mechanisms back of the kidney, nor the kidney itself. It will not discuss the decreases in extracellular fluid due to perspiration and urination, nor the increase due to oxidative metabolic processes. It will not discuss the body's abundant means of compensation, this automatic management of extracellular fluid, or "homeostasis," borrowing the term from Dr. Walter B. Cannon. It will not try to bring into the picture the "internal climate" or "immediate environment" of the animal to quote Claude Bernard once more, as altered by disease, old age, poisoning of one kind or another, malignancy or starvation. Rather it will dwell on the fact that virtually water exchange in the body is due to replacement of losses of extracellular water. The intake by mouth especially is intermittent, the output is continuous and of variable degree. There must be within the animal a constant adjustment of this extracellular fluid.

The kidney cannot play traffic officer fast enough in directing fluid traffic through it to keep the osmotic equality stable between extra and intracellular fluids. There is needed a supplementary function other than that of the kidney to make the necessary osmotic adjustment. This supplementary function is the part sodium plays, sodium being the constituent in greatest concentration in extracellular fluid and fixed there normally because it is not permeable to cell membranes. This means then water has to shift in or out to make concentrations of sodium proper, in other words water moves to give osmotic equality between the fluids, inside and outside of cells.

This osmosis is measured by a unit, coordinate with milliequivalent but called "milliosmol" and designated "m-osM." The relationship may be crudely stated by saying that in milliosmolar measurement you count the number of men, in milliequivalents you indirectly recognize the presence of men but your emphasis is on counting their arms—their strengths to unite with other metabolic particles. The milliosmol per liter differs from milliequivalents/liter in this respect: $\frac{\text{mg/liter}}{\text{at. wt.}}$ rather than $\frac{\text{mg/liter}}{\text{equiv. wt.}}$. Hence for univalent ions the milliequivalent and milliosmol are identical, for divalent the milliosmol yields two milliequivalents. The use of the milliosmol is to picture a substance for instance NaCl, measuring its osmotic nature, osmosis being dependent on the number of particles, not on their valences. A milliequivalent which for sodium chloride would also be a milliosmole neglects to express the fact that NaCl ionizes almost completely into Na^+ and Cl^-, so upon dissociation the number of particles present are doubled. This additive value is understood in the definition of milliosmol. To illustrate: In osmotic forces a milliequivalent of NaCl becomes 2 milliosmols of particles effective in the osmotic processes.

Figure 4 gives an insight into particle relationship and fluid transfer. The horizontal lines, whether solid or broken measure the salt concentration in terms of milliosmols; the vertical lines the volume of fluid in terms of liters. Therefore the solid lines limit normal conditions, i.e., the proper distribution of water in health and the salt concentration peculiar to it. The broken lines give the change in distribution of water, in the middle segment of the figure a gain of 15 g. or 500 m-osM of sodium chloride, and in the extreme right segment a loss of 15 g. or 500 m-osM of sodium chloride. In the one instance extracellular fluid increases from 14 to 15.1 liters; in the other, fluid decreases from 14 to 12.8 liters. In studying these osmotic forces little regard is given the non-electrolytes for the osmotic value of extracellular fluid is made up almost wholly of the sum of the ionic

Fig. 4 OSMOTIC VALUE OF EXTRACELLULAR FLUID



constituents. It becomes apparent that in making chloride determinations, for instance, that a clinician receives little benefit from a reading of 200 mg.% sodium except to know it is exceptionally low. But to give the clinician a reading of 90 m-osM gives him at once a foundation on which to start his fluid therapy.

This exposé shows the need of particle count rather than mass measurements to restore water balance. It might be extended to include a study of the biphosphate ion, and the sulphate ion as related to water balance. It might be projected into a consideration of gastro-intestinal disturbances as characterized either by continuous vomiting or diarrhoeal conditions, or the hypotonicity of plasma as related to anuria. But these additional projections should not be necessary to argue for adopting mEq as a quantitative method of expressing electrolytes and CO_2C.P.

The examples given should suffice. Even though less contributory toward interpreting pathology, the practice might be extended to include all metabolites to make reports uniform.

This concludes the discussion on the adoption of milliequivalents. The practice is already routine in some laboratories. It makes no more work for the chemist, save to translate his findings into new terms, and this is relatively simple. For the newer generation of doctors it is satisfying to have an enlightened chemist putting his findings in such terms. It aids the practitioner in establishing his diagnosis; it enables him to institute a rational type of therapy promptly. For the medical technologist himself it should be a stimulus to be more than a cook following recipes. It should and will challenge his thinking and broaden his intellectual horizon as a chemist. It may challenge him to make the necessary additional observations and with proper authority the analyses to complete the picture of "stability" using the language of Claude Bernard.

Part II

The next problem is that of uniformity in the type of material used for blood chemical analyses, for instance the adoption of blood serum for all determinations. It is permissible to use serum for almost all clinical chemistries, fibrinogen excepted. In many institutions it is being used whenever possible and permissible because it eliminates the use of anticoagulants, which chemically "contaminate," dilute, and sometimes interfere with the reagents to be added later. It eliminates the commonest difficulty encountered in sending specimens to another laboratory, that of hemolysis. And it also eliminates that insidious error which enters into an analysis by diffusion of intracellular constituents such as potassium across the cell membrane into the serum. Serum is usually clearer. Many methods are already based on the use of serum and most others could use serum with only a slight modification or sometimes none in the technique. In some of the larger laboratories serum is being used extensively. If the practice is adopted universally it will mean a reconsideration of normals and a comparison of values in serum, plasma and whole blood. But this might be a very good thing because already, with the finer instruments of determination, the textbook values for normals are being falsified. In visiting a Minnesota hospital laboratory recently the chief chemist presented the author with the following summary of normals stating: "These are the normals as we have found them to be in our laboratory."

SUMMARY

Test	Normal	Test	Normal
Sugar	70–100 mg %	Calcium	4.5–5.5 mEq
BUN	8–22 mg %	Phosphorus	3 –6 mg %
Creatinine	1– 3 mg %	Acid phosphatase	0 –4 K.A. units
Chlorides	99–108 mEq	Alkaline phosphatase	4 –12 K.A. units
Uric Acid	1– 4 mg %	Amylase	64 –132 mg %
CO_2C.P.	50–75 vol. %	.....	.....

The sugar and BUN readings are not textbook models; they have been tailored according to the techniques and instruments current to clinical chemistry as practiced in that institution. Other revelations might be made with the findings of normals in the universal adoption of serum for chemical determinations.

Some chemistries are still in the experimental stage. Reference is being made to thiocyanate determinations, for instance. A biological house insists that their brand of thiocyanate should be determined on whole blood while the clinical pathological laboratories insist on the use of serum. Medical technologists report they find no correlation between the quantities recovered by the two techniques, and so are obliged to analyze whole blood to give an indication as to what therapy is still indicated, and give serum report for a "general guide" to use their exact words.

The general practitioner is usually too busy to note whether the reports come in terms of whole blood or serum, and may be misled by promiscuous use of normals, especially in such determinations as are still somewhat experimental.

As stated above serum may be used whenever possible. There are times when an analysis dependent on serum for the specimen requires more blood than can be gotten from the patient; this is particularly true when working with children, in which instance the chemist is often fortunate if he obtains the required volume of blood without trying to double the amount in order to obtain only serum. Another disadvantage is the time element, and the question arises is there justification for the delay in an emergency or night call? Lastly is there justification for not only the lack of economy of time but the lack of economy in wasting one-half of every syringe of blood drawn by throwing the cells into the sink?

The next point is the nature of the chemical analyses to which smaller laboratories should limit themselves as a matter of routine. This can hardly be identical but some generalizations should be possible, recognizing not one factor but a number as the limiting ones. In order 1. Personnel and in importance, priority goes to the pathologist, if the institution is fortunate enough to have the services of one. The decision as to what

procedures the laboratory should do rests with the pathologist as an intermediary between the laboratory and the staff doctors. In the event there is no pathologist, the load depends somewhat on the demands of the medical men and their training. More will be said concerning this later.

With respect to the pathologist the best counsel for the medical technologist usually comes from the pathologist and no medical technologist likes to be without this. The access to a pathologist is difficult at times. There are communities in Minnesota where the size makes it impossible and uneconomical professionally for a specialist to become a resident pathologist. Traveling pathologists, working on a part-time basis may make a weekly visit to the laboratory. In the absence of this, consulting pathologists are to be found. These are they who receive in their office usually in a larger center, a prepared blood smear or tissue section and interpret its meaning. Akin to this is the help given by the State Board of Health which handles agglutinations, and the like satisfactorily, but nowhere is there a solution for difficulties in chemical analyses unless affiliation with a larger institution is to be had. For chemists in these smaller laboratories, the nearest to solving the pathologist problem is to know who the state's pathologists are and where they are to be found.

The key person next to the pathologist and his medical staff is the medical technologist in determining the types of chemistries and the number to be done, and his help depends on the education and the nature of the responsibility placed on him. Most of the institutions concerned in this discussion are laboratories in a hospital of a bed capacity between 20 and 125 beds. The laboratory attached to that institution may range from a room with all work done in a single space to larger areas of space departmentalized. If the medical technologist singlehanded is responsible for the single space, not too many chemistries can be done. If he is supervisor of only a department, and there are others to help he may be able to perform a great variety of tests. But in either instance, the education of the medical technologist has to be of first concern. To comprehend some of the theory discussed earlier in this paper, the medical technologist must have a preparation in chemistry covering fundamentals in general chemistry, qualitative and quantitative analyses, fundamentals in organic, physiological, and at least one year of experience in a hospital laboratory with clinical chemistry. To handle adequately some of the newer types of equipment a year of physical chemistry is rapidly becoming a must even if gotten as post graduate work. Now the series of chemistry courses enumerated add up to a degree course in an accredited college affiliated with an "approved school." Parenthetically

some allowance must be made for the veterans who were so unfortunate as not to see much college but who have spared nothing to advance themselves by an on-the-job training. The Civil Service Commission and the Armed Services recognize this type of experience as equivalent to academic study. So for the veterans in medical technology there is no question but they constitute acceptable personnel but for the younger generation to assume a chemist's role in a laboratory following a nine-month course is nothing short of great injustice to the medical profession and to the patient. A laboratory aide may be taught the simpler tests but he may be allowed to practice only under supervision of a qualified medical technologist.

2. The size of the laboratory, i.e., the physical space allowed and the equipment in the laboratory. Certainly extensive distillations, titrations, and refluxings cannot be done in a corner. Electrically operated machines such as an Evelyn colorimeter with its galvanometer attachment, or the spectrometer, are not operable in a room that is subject to "stray currents" and vibrations from heavy machinery elsewhere. No laboratory should undertake turbidity determinations of the nature of a zinc (Kunkel) or thymol turbidity test without a colorimeter. A comparator bloc will not be suitable. Even if a hospital installs an extraordinary piece of equipment, there must be an operator; one without the other is useless.

3. The nature of the test to be made. Here the facets pertain to the nature of the solutions, whether thermolabile, photolabile, and otherwise unstable; the time consumed in the technique; and the frequency of performance of the technique. Granted that the solutions and the techniques are not too involved, one test ordered out of routine upsets the chemist's program for hours. This can be illustrated best by citation from an experienced medical technologist, Mrs. Nell Butler. She says:

> "I think it is of great value both to the laboratory and to the doctor if a battery of tests or a test is made routine, for then the medical technologist may be reasonably sure from the new admissions, the laboratory load of the next day, and can govern the extra test accordingly. You won't go ahead and do one chemistry on one case and then find that another doctor later orders another; it is easier if ten patients are admitted to do the ten tests together than to do one at a time. You are ready for some extras in such organization."

And lastly 4. A group of miscellaneous factors of which the following are the most pertinent:

a. The nature of the patients in the institution or served by the clinic or the office; b. the type of practitioners; c. the proximity to larger laboratories; d. the communication facilities;

e. the expense to the laboratory and hence to the patient, and f. the legal involvements.

The laboratory in a sanatorium is apt to be more limited in its needs than one in a general hospital. The type of practitioners does make a difference; the younger generation of medical men have been given much training in laboratory work in the medical schools and borrowing the words of a medical technologist in a center where young men are practicing: "All the young men now graduating must have chlorides and more chlorides and A/G ratios or they can't prescribe." As to being near a larger laboratory such as those of the University or the Mayo Clinic chemistries might be directed there. Parenthetically experience shows that oftentimes it is better to be able to handle more of the work locally for institutions differ—some reports come back in great detail proving an asset; others are so limited that they leave something to be desired.

Without reference to solutions or to techniques such chemistries as are vital to establishing a diagnosis or directing a therapy cannot be forwarded to a larger center when the results must be known in 20 to 30 minutes. Even those for which the medical man can wait three or four hours will never prove of value if forwarded to a larger center for performance.

As to proximity to larger centers and communication facilities, these will be treated in the concluding paragraphs of this paper. Now as to expense to the laboratory and ultimately to the patient. Are not the high salaries of the properly trained personnel, plus the cost of laboratory reagents and equipment major factors in determining the charge put on the rent of a room in a hospital? Is there any moral obligation on the part of the medical technologist, the pathologist, and the medical man to consider this feature?

Tests may be subject to legal implications. Such tests rightfully do not belong to a clinical pathological laboratory but a toxocology laboratory for execution. Several reasons make this true, first—the medical technologist is not legally-minded and to have to bring her (men don't mind) data into a courtroom and defend it is putting an extra tax on her that is not even rewarded financially. Secondly the reagents needed for such tests are complex usually, the techniques are complicated and the equipment involved. The expense of doing an occasional test of this type is way out of bounds to the good accruing from it. These tests are alcohol determinations in blood and other body fluids, lead in urine, arsenic and mercury poisoning, and some of the other analyses peculiar to detecting occupational diseases.

Telescoping the whole discussion of limitations on chemistries, it follows that chemistries should not be expected of small

laboratories (those serving 20-125 beds) that are not frequently requested, or whose reagents are too complex, and too unstable to be stored satisfactorily, or whose techniques are too complex and involve expensive equipment out of proportion to the advantages accruing to the patient, or to the advance of medical science. The following list is suggestive of the chemistries that are considered such as will not fall under the above prohibitions:

Albumin-globulin ratio; blood sugar; bilirubin* (van den Bergh, icterus); calcium; carbon dioxide, C. P.; cephalin flocculation (Hanger's); chlorides; cholesterol;* creatinine; NPN; phosphorous; phosphatase (alkaline); proteins; sugar and chlorides on spinal fluids and uric acid. Some have a regular liver profile* set up in their laboratory scheme of tests and these usually are the tests making such a profile: A/G ratio, bilirubin, cholesterol-total and esters, Hanger's, icterus index, alkaline phosphatase, prothrombin time (some variety of), total proteins, thymol turbidity, urobilinogen in stool and urine. (Note: Most of the above are on blood.)

The last point in this paper to be discussed is the packaging of specimens for chemical analyses to reach other centers through the mail. While the analyses are to be limited in this discussion to chemical, some details may cover specimens that are often sent for serological, hematological, bacteriological, histological and urological determinations.

Larger institutions do not encourage "mailed in" specimens, and certainly not those arriving over the weekend, or from patients not registered with them.

If a smaller laboratory affiliates with a larger for chemical determinations, some of these factors might be considered: A laboratory fee schedule should be published so that the hospital is not charged with a liability incurred by a patient that has been discharged before the results and the bill arrive; or that a patient is not overcharged in anticipation of a discharge before returns are made. Secondly there should be some understanding from the receiving laboratory how the specimens are to be sent, using common sense in carrying out the directions. One laboratory volunteered the following as adequate data:

1. Name of the hospital or laboratory and complete address of the institution forwarding the specimen written on a label pasted on the container and not only on the packing. Too often the receiving clerk discards the wrappings and carries the specimen to the laboratory unwrapped. Sometimes the specimen reaches the chemist with only, to illustrate: "Do an alkaline phosphatase on Johnson." When asked the objection to that particular amount of data the chemist half-humorously said, "I'd hate to think Ed Johnson got Roy Johnson's findings. It just goes against the grain."

2. Name of patient including initials, sex, age.
3. Name of attending doctor.
4. Chemistries desired.
5. When blood was drawn—day and hour.
6. To whom the bill is to be sent.

In packaging specimens, many of them are on the way more than 24 hours, so there will be need of a preservative. Fluoride is acceptable for alcohol determinations, likewise for blood sugars, the concentration being sodium fluoride 10 mg/cc. For blood sugar fluoride will prevent glycolysis, otherwise glucose disappears at a rate of 14 mg/hr. This indicates the need for setting up the filtrate promptly. Sending filtrates by mail provokes more problems because it is hard to find a universal protein precipitant. Trichoracetic acid may be too costly or undesirable when a practically neutral filtrate is desired. Blood urea nitrogen is best sent if long in transit as oxalated plasma or serum; and bloods for enzyme determinations, such as serum amylase or phosphatase should be sent frozen, packed in dry ice to insure true results. It is a known fact that acid phosphatase values fall after standing one hour at room temperature, or 3-4 hours standing in the refrigerator while the alkaline values rise after the same time.

If a specimen is to be sent on which serology or bacteriology is also requested it is obvious such a specimen should be collected and sent under sterile conditions. The prevalence of this type of work being combined with chemical analyses is diminishing in Minnesota particularly because of the fine service extended by the State Board of Health and its branches in taking care of the bacteriology and serology. It does away with that oft-repeated report: "Gram positive cocci present."

The handling of radioactive isotopes may serve for another paper.

The specimens need a proper anticoagulant when plasma is needed, and the proper volume. Institutions differ in the quantities needed, but most of the larger centers supply the data as to volume and type of specimen for the chemistry desired. Such a list is gotten by request. This item of volume is most often abused in that there is not enough of a specimen forwarded for all the tests requested.

The last item is the matter of packaging. The United States Postal Department is to be commended for its practice of handling the containers with material for analysis at hospital or health centers. While the package goes for parcel post rates it is pocketed with first class mail. Direct delivery of specimens of course is to be preferred but special delivery by mail is second to it.

Leakage is the next problem. To avoid it specimens sent in stoppered bottles, re-enforced with adhesive are not so well protected as those sealed by dipping the corks in paraffin and then sealing the paraffined cork with still more paraffin. Absorbent material is fine for wrapping the container before placing it in the box for mailing. If sodium is to be determined even paraffin lining the tube containing the blood might be in order to avoid leaching of the sodium from the glass. Screw top tubes are proving to be leak-proof.

THE GAVEL

Six months have passed since I first greeted you. In this time we have faced many problems, but with your wise counsel, your cooperation, and your confidence we have been able to meet the issues and arrive at decisions which are in the best interest of ASMT.

As we face the NEW YEAR I continue to solicit your help and your confidence, for we have another busy six months ahead of us. There are so many possibilities for rapid progress that the work of this office—if carried on properly—should be a full time job. So, if you should wonder why ASMT doesn't do this or doesn't do that, just remember that your Officers, Board Members, and Committee Members have jobs that demand a certain amount of their time and that their ASMT duties must be taken care of "after working hours." Without your help we could not have accomplished the things that we have to date.

I would like to call to your attention some of the things which YOU can do in these next six months:

ASMT CONVENTION: June 14-18, 1953, Brown Hotel, Louisville, Ky.

Plan to attend. Your presence is needed. If you are a delegate, you will have a part in planning for the future, in the election of the Officers and Board members, in deciding the business matters which will be on the Agenda for the meeting of the House of Delegates. If you are not a delegate, you will profit by the workshops that are to be presented, for you will learn how ASMT functions. You will also learn how YOU can help to make ASMT function more efficiently. There will be scientific papers and social functions that you can not afford to miss. Besides, your friends will be there—you know that you want to see them!

An added attraction this year will be the OPEN HOUSE planned by the REGISTRY. There will be two possibilities for you to visit the Registry of Medical Technologists, Muncie, Indiana. One will be to stop by the REGISTRY **on your way to** Louisville; the other, stop by the REGISTRY **on your way home** from Louisville. Announcements will be made as to the exact dates later. I might add that if you have never been to the REGISTRY you have missed a thrilling experience. You will be amazed at the amount of work done and will be delighted with the set up of your REGISTRY. I am proud of it—you will be, too, but you will have to visit and see it in operation in order to appreciate it.

CONSTITUTION & BY-LAWS: According to the instructions of the House of Delegates this committee is revising the Constitution & By-Laws. I would like to remind you that a careful study of these revisions is necessary if your delegates are to be instructed to vote according to the wishes of your State Society. You will have a voice in this important tool, so study it carefully.

NOMINATIONS & ELECTIONS: This committee was dependent upon your suggestions. I hope you submitted the names of many capable candidates. If you did, the committee will be able to do a good job. If you didn't, don't blame the committee if the slate is not what you wanted. When the slate is announced in the March AJMT, study each candidate and his qualifications carefully, decide which will do the best job for ASMT, and then instruct your delegates to vote according to the wishes of your State Society.

AGENDA: It is time that you were sending me the items that you would like to be placed on the Agenda for the June meeting. This is your privilege as a member and/or as a State Society. Start doing this NOW, for April and May will be busy months for all of us.

And now I would like to wish for each of you a bright, prosperous, and happy 1953. And for ASMT, the culmination of all hopes, dreams, and efforts to make this a strong Professional Society worthy of YOU.

Sadie Cartwright, MT(ASCP)

FROM WASHINGTON STATE

Recognition has been accorded to MRS. JACQUELINE BAHRENBURG, President of the Washington State Society of Medical Technologists, chosen "Soroptimist of the Month" for November, 1952, by the American Federation of Soroptimist Clubs. Beside her outstanding work in her own profession where she is a leader locally and in the state, she has done yeoman service on recruitment. She is a member of the faculty of both Washington State College and the University of Idaho. To quote from the *Spokane Daily Chronicle*, in its write-up concerning the above honor, Mrs. Bahrenburg "has been a member of the city plan commission for 18 years and now is its secretary-treasurer, the first woman to hold office in the commission. She is active in a number of other organizations, including the Federated Women's Clubs" . . . She is "a member of the Little Theatre Board, the American Association of University Women and St. John's Episcopal Cathedral." In each of these organizations she has been an active worker and has held office or other positions of responsibility. "In 1951 she was chosen Spokane's 'woman of achievement.'"

AMONG THE NEW BOOKS

Today's books would make up a very serviceable library for any laboratory. For a medical technologist a blanket order would keep him up with most of the current techniques as well as many of the old standbys. For the specialist working with radioactive chemicals, the volume of choice would be:

MODERN RADIOCHEMICAL PRACTICE: G. B. Cook, Ph. D. and J. F. Duncan, D. Phil., Harwell, England. Oxford University Press, London. 1952. 391 pages. Table of Isotopes, 4 plates, $8.50.

Although highly specialized and thoroughly new in its application to medical technology, this volume will prove invaluable to the individual engaged in the research laboratory using radioactive chemicals. It is written very much on the practical side, as evidenced from the chapter headings: Radiochemistry first gives some of the factors which affect radiochemical separations as well as the use of radio-elements in chemical investigations. This practical approach gives the applications of radio-tracer techniques in chemistry as well as the laws of radioactive decay and determination of half-lives and energies of nuclear radiation. The use of the Gieger Muller counter in comparative and absolute measurements of activity is shown. There are thirty experiments with practical applications of techniques. Health hazards and precautions are presented as a part of the text.

More on this subject, but from a less practical standpoint is:

HARWELL, THE BRITISH ATOMIC ENERGY RESEARCH ESTABLISHMENT: Philosophical Library, New York, 1952. 128 pages, 32 illustrations, 9 diagrams.

This is a report which is primarily in the form of a description of the programmes in the atomic energy studies. It is not so much a part of the technologist's library as most of the books reviewed here. The research chemist would, however, be interested in its contents covering the Production, Isotope, Reactor, and Accelerator Programmes.

You begin to wonder why it hasn't been done before, and with reference to ALL branches of medical technology when you see:

PRACTICAL CLINICAL CHEMISTRY: Nell F. Hollinger, Ph. D., Assistant Professor of Laboratory Practice, Univ. of Calif., Berkeley. The National Press, Millbrae, Calif. 1952. Three Parts: I. PRINCIPLES. 77 pages. II. Notes on Methods. 59 cards, bound. III. Solutions and Reagents. 93 cards, bound. $4.50.

In these three small books the medical technologist in the clinical laboratory will find the most practical answer to his problems of "where to find," "how," and "why." The first booklet gives a rapid "run-down" in outline form, History and Review, Origin, Route, Absorption, Role, Composition (Normal Values, Tests—listed, causes for alterations) for the various body fluids upon which chemical testing is commonly done. II. NOTES ON METHODS is just what the name implies. The best description is given by the author herself who says, "An attempt has been made to outline the laboratory procedures as concisely and clearly as possible." This book may be set up as a card file (the cards are 4 x5½" in size and are printed on a postcard quality of paper) which means that it can be kept up to date by one's own ingenuity, preferences, and "pet techniques," in addition to III. SOLUTIONS AND REAGENTS, which is set up in the same manner. This set of cards gives not only the formulae for the solutions themselves, but has notes on the specific uses, stability, and approximate number of tests for the amount involved. If you do any biochemistry, you will not regret having the booklet and card files handy.

CLINICAL LABORATORY METHOD: W. E. Bray, B.A., M.D., Professor of Clinical Pathology, Univ. of Va., Dir. of Clin. Lab., Univ. of Va. Hospitals Ed. 4. The C. V. Mosby Co., St. Louis, 1951. 613 pages. 119 Text illustrations, 18 color plates. $7.25.

This edition of one of the standard references comes up to the usual measure with the addition of improved techniques where they have been proven, as well as with the new methods and procedures for new subjects for testing. Clinical methods for such of the later tests as the action of the anti-coagulants, antibiotics, etc., are included. Some of the sections have been enlarged upon or rewritten, with additional charts and illustrations. The volume has lost nothing of the conciseness of the previous editions, but is the old favorite brought up to date.

HEMATOLOGY For the Medical Technologist: Charles E. Seiverd, B.S., MT (ASCP), Chief Technologist, Doctor's Clinical Laboratory, Director of Research, The Horizon Laboratories, Sunnyslope, Arizona. Lea & Febiger, Philadelphia, 1952. 180 pages, 45 illustrations, 7 plates in color. $3.50.

This book is as its title indicates, a volume on HEMATOLOGY for the Medical Technologist, by one of them who is familiar with their problems and the solutions. It is of special value to the student in that the various procedures are explained in detail with the reasons for the successive steps in the performance of the hematologic procedures. Of more interest to the student is the section giving the replies to many common questions, as well as guidance in preparation for the Registry examinations. This information will help the practicing technologist as well. The explanations of terminology are especially concise. The entire book features nomenclature as recommended by the A.S.C.P. Committee.

PRACTICAL BLOOD GROUPING METHODS: Robert L. Wall, A.B., M.D., Department of Research Medicine, the Ohio State University Hospital, Columbus, Ohio. Charles C. Thomas, Springfield, Illinois, 1952. 175 pages, $5.00.

This new manual of immuno-hematology answers the question of "where to find" in the literature all the references to the newer blood types (Rh-hr), etc. The ABO, MN (S) and P systems are described as are the "Duffy," "Jobbins," Kell, Lewis, and Lutheran. All of this has heretofore been found only in the journals. The development of the blood group systems is given in as much detail as is known at the present time. The appendix gives the preparation and use of Coomb's anti-globulin as well as the preparation of anti-sera.

HEALTH RESOURCES IN THE UNITED STATES: Personnel, Facilities and Services: George W. Bachman and Associates. The Brookings Institution, Washington, D. C. 1952. 344 pages, 16 tables. $5.00.

This volume is a survey of facts and figures concerning the personnel, facilities, and services available to the nation in its health needs. It is good reference material. The medical technologist is recognized statistically, with a brief mention in connection with "Other Health Personnel." There is an estimate that there were, in 1950, 30,000 medical technologists and technicians of whom "a little over half" . . . "were registered medical **technologists**, trained in schools approved by the Council on Medical Education and Hospitals of the A.M.A. The others were technicians without approved training." The sections on facilities and services would be of value as a study of the health structure that is available to the people of this country.

TUBERCULOSIS: Saul Solomon, M.D., Associate Clinical Professor of Medicine, New York Univ. Post-Graduate Medical School. Coward-McCann, Inc., New York, 1952. 310 pages. $3.50.

This book deals primarily with the recent advances in diagnosis and treatment of tuberculosis. In telling of the newer drugs, it presents their limitations and emphasizes the fact that many of the older procedures in treatment cannot be abandoned. There is one chapter devoted to "Laboratory Aids in Diagnosis and Management of Tuberculosis."

THE ORIGIN OF LIFE AND THE EVOLUTION OF LIVING THINGS: an Environmental Theory: Olan R. Hyndman, B.S., M.D., F.A.C.S. Philosophical Library, New York, 1952. 648 pages, 42 diagrams. $8.75.

Interesting to the medical technologist and to his compatriots in the fields of medicine, is this expression of one point of view in an explanation of the evolution of living things. Basing an argument on the thesis that "no discovery was ever made by one who was not looking for something," the author feels that in order to find the key to biologic disorders, there must first be a concept of "order." It is fascinating reading, and certainly gives rise to considerable thought. There is not one of us but that would profit by a careful consideration of the matter presented. We could well apply much of it to our own philosophy.

ESSENTIALS OF HISTOLOGY: Margaret M. Hoskins, Ph. D. and Gerrit Bevelander, Ph. D., New York University. Ed. 2. C.V. Mosby Company, St. Louis, 1952. 240 pages, 135 text illustrations, 2 color plates. $4.00.

This volume is as necessary to the histology technician as the knowledge of normal values is to the general technologist. Morphologic characteristics of tissues and organs are given in understandable terms and illustrations. As a basic reference this book is especialy good, although to become indispensable in the laboratory library, it would require at least an appendix on staining properties of normal tissues.

ZINSSER'S TEXTBOOK OF BACTERIOLOGY: David T. Smith, M.D., Norman F. Conant, Ph. D. et al, Duke University School of Medicine. Ed. 10. Appleton-Century-Crofts, Inc., New York, 1952. 1012 pages, 328 illustrations. $11.00.

As in previous editions this bacteriology guide remains a "must" in the laboratory library. It carries through the usual practical applications of a specialized field of medical technology, and has not disregarded the increasing attention to the field of virology. The newer antibiotics are given consideration as are the effects of ACTH and cortisone on the various infections. The final chapter has the usual invaluable techniques for bacteriological, immunological, and serological testing.

ULTRAVIOLET RADIATION: Lewis R. Koller, Ph. D., research Associate, General Electric Research Laboratory, Schenectady, New York. John Wiley & Sons, Inc. New York, 1952. 270 pages, 148 illustrations and charts, 77 tables. $6.50.

Some months ago we were searching through the literature for just the information contained in this book. We found many references in many books, all very technical, but to sift through and find the answers in concise and understandable form was difficult. The chapter most applicable to the medical laboratory is that on "Some Applications and Effects of Ultraviolet" in the section giving its germicidal effects.

ABSTRACTS

DIAGNOSIS OF FUNGUS INFECTIONS: Donald M. Pillsbury, M.D. and Albert M. Kligman, M.D. A New histochemical tool for the definitive diagnosis of fungus infection. Tr. New York Acad. Sc. 13: 145-148 1951

Fungus cells are easily demonstrated in biopsy specimens, exudates, tissue fluids, or skin scrapings when stained with the periodic acid-Schiff technic. The method is practical and the results are far superior to those from potassium hyroxide mounts.

Fungus cells stain red or various shades of magenta with the periodic acid-Schiff technic. The tissue background is colorless or slightly pink. Excellent contrast is afforded and a moment's glance is sufficient to locate the fungus.

The technic is described as follows:

A drop or two of egg albumen is placed on the lesion, which is then scraped with a knife. The scrapings are smeared over the slide. The formula is:

1. Immerse slide in 95% alcohol one minute
2. Immerse in 5% aqueous solution of periodic acid three minutes
3. Wash in running water two minutes
4. Stain in Schiff reagent eight minutes
5. Rinse in running water one minute
6. Dehydrate through 95% alcohol, absolute alcohol, and xylol. Mount in clarite.

Steps 6 and 7 may be omitted if permanent mounts are not required. Mounting is then done in a non-acid water soluble medium after step 5.

Tissue may then be processed by any fixative, embedded, sectioned, and dehydrated. To stain sections:

1. Deparaffinize in xylol. Rinse in absolute alcohol, then in distilled H_2O. 2. Immerse in 1% solution of periodic acid five minutes. 3. Wash in tap water five minutes. 4. Transfer to Schiff reagent ten minutes. 5. Wash under tap water ten minutes. 6. Dehydrate, clear and finally mount.

DETECTION OF OCCULT BLOOD IN FECES: Ann Peranio and Maurice Bruger, M.D.

Finding traces of blood is a simple, rapid method of screening for gastro-intestinal cancer.

Sensitivity of several common reagents was determined by Ann Peranio and Maurice Bruger, M.D., at New York University, New York City. Subjects were ward patients and healthy medical technicians.

Orthotolidin is the most sensitive indicator, followed by benzidine, phenolphthalein, and guaiac in the order listed. The first often gives false positive results, however, and benzidine may be oversensitive unless the quantity is limited. The diet should include no meat or fish for seventy-two hours before the orthotolidin, benzidine, or phenolphthalein test. With guaiac, diet does not need to be restricted. Healthy subjects on a meat-free, fish-free regimen can produce positive reactions only by swallowing blood before the test. Amounts required are 1 cc. of blood before the orthotolidin test, 3.5 cc. before the benzidine or phenolphthalein test, and 20 cc. before the guaiac test. With unregulated diet, 2 to 3 cc. of blood will give a faintly positive guaiac test. Results are not altered by slight bleeding from the gums after use of a toothbrush or by food containing chlorophyll. Ferrous sulfate may possibly affect orthotolidin, but not the other reagents. False positive reactions or color interference may be caused by copper sulfate, ferrous chloride, potassium permanganate, potassium iodide, sodium nitroferricynanide, colloidal iron, mercuric chloride, or pus added directly to reagents. The indicators are not suitable for occult blood in urine, since urine inhibits the chemical reactions.

* The detection of occult blood in feces including observation on the ingestion of iron and whole blood. J. Lab. & Clin. Med. 38:433-455, 1951.

The above material was abstracted from Modern Medicine April 1, 1952.

James Parrott—Lafayette, Louisiana

THE EXECUTIVE OFFICE AND ITS LOCATION

The Executive Office as it is now organized began its operation in Houston, Texas, September 1, 1949. This was accomplished as a result of the 1949 ASMT Board of Directors' action when it was deemed necessary to increase the facilities of the Executive Office. "At that time the Board ordered a full-time office set-up and obtained the services of a full-time Secretary-Editor, the AJMT to be edited from the same office." The quotation is from a notice appearing in the AJMT, January-February 1951.

In June 1951, at Swampscott, Massachusetts, a committee was appointed by the Chairman of the Board of Directors to investigate various centrally located cities for the purpose of moving the Executive Office. This committee was also directed to report on the matter of hiring a professional executive secretary. At the same time Miss Lucile Harris was directed to write a report to be submitted to the Chairman by October 1, 1951, giving the committee reports on this subject.

In the opinion submitted September 30, 1951 by Miss Harris, she states in part, "It seems there would be available space in almost any city we might decide upon—rent and salaries depending on the desirability of locations plus duties and responsibilities assigned to an executive secretary." However, with the material submitted is not definite enough to recommend any change. "The executive office in it's present location is already set up and functioning. If a change is to be made we would need a definite outline of any advantages to be received.

"In this day of fast mail service I doubt seriously if there would be better mail service out of another place than there is out of our present location."

In June 1952, Portland, Oregon, at a Board of Directors Meeting, the Chairman appointed a committee of three to continue the investigation of a possible site for the Executive Office.

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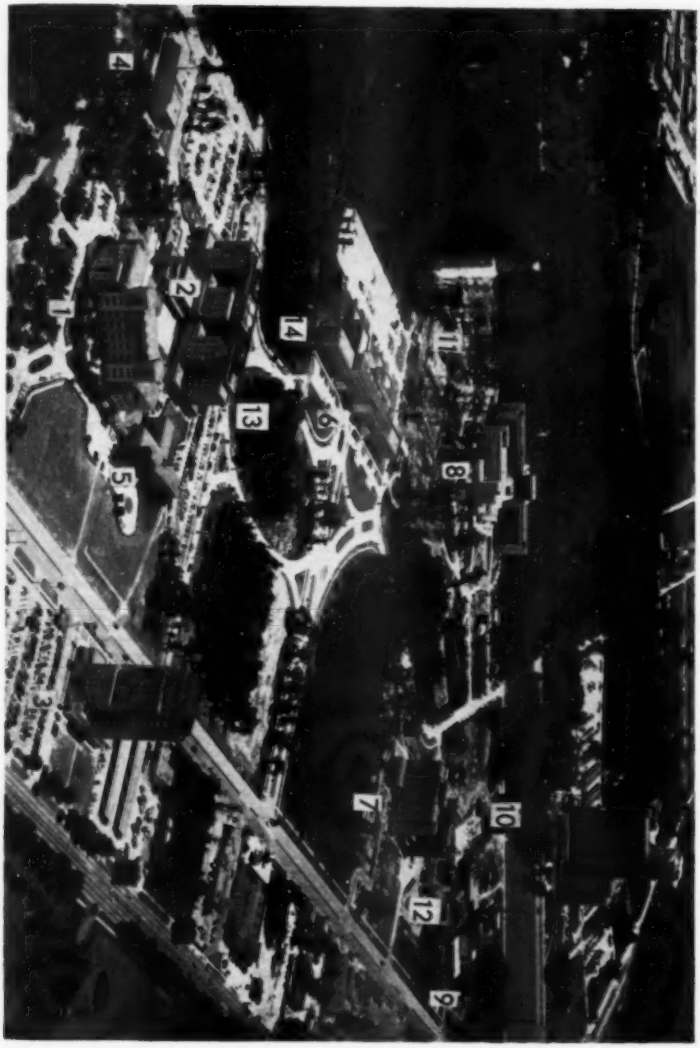
Aerial view of the Texas Medical Center. Five miles out from the heart of the Houston business district, it is located on a 163-acre tract bounded by Hermann Park, Fannin Street and Holcombe Boulevard, and is just one block away from the eastern boundary of Rice Institute.

(1) Original Herman Hospital, gift of early Houston philanthropist, George H. Hermann; (2) New Hermann Hospital, 300-bed addition (completed 1949); (3) HERMANN PROFESSIONAL BUILDING, office building for physicians, dentists and medical laboratories, (the EXECUTIVE OFFICE of A.S.M.T. is located here); (4) Arabia Temple Crippled Children's Clinic, also houses the headquarters of the Univ. of Texas Post-Graduate School of Medicine; (5) Univ. of Houston Central College of Nursing; (6) Baylor University College of Medicine, (completed 1947); (7) Methodist Hospital (completed 1951) housing the Houston Speech and Hearing Center; (8) M. D. Anderson Hospital for Cancer Research, University of Texas (to be completed summer 1953); (9) Texas Children's Hospital (to be completed early summer of 1953); (10) St. Luke's Episcopal Hospital (to be completed by early 1954); (11) University of Texas Dental Branch (to be completed 1954); (12) boiler plant and laundry serving Methodist Hospital, St. Luke's and Texas Children's Hospital; (13) Medical Library of the Houston Academy of Medicine (to be completed early in 1954); (14) site of the new Jefferson Davis Hospital, 700-bed city-county charity hospital on which construction is due to begin about mid-summer 1953.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As a member on the committee to look into an appropriate site for the Executive Office I reasoned that it would be well to first look over our present location in Houston.

My visit to the Executive Office was made in September at my own expense.

The home of ASMT is in the Hermann Professional Building located just a few minutes drive from downtown Houston. The Hermann Professional Building is devoted solely to the medical and dental professions. There are other related services located on the ground floor and in the basement. I was greatly impressed by the nearness of the office to the medical centers of the city. It is close to the Baylor University College of Medicine and to six hospitals, either completed or in the process of building, with at least one more hospital in the planning process for the center, together with the medical library also in the early building stage. Of incidental interest is the number of new office buildings in the vicinity, among them the new Southwestern Office of the Prudential Life Insurance Company.

In selecting an office site it is recommended that one should look for (1) the proximity of related services and (2) proximity of supplies. Of course, service given to the individual members is not to be overlooked. This too was given careful consideration.

All necessary supplies and service for operating the ASMT office are close at hand. The Addressograph-Multigraph Company is on the same street less than a mile away, typewriter services are also near, with office supplies being available upon two hours notice, and paper stock available on four hour notice. Paper stock is purchased from a wholesale paper house in quantities which effects the greatest savings. The Gulf Publishing Company, publishers of the AJMT is also located in Houston.

The personnel of the Executive Office at the time of my visit consisted of the Executive-Secretary, two full-time clerical employees and one part-time employee. The proximity to Rice Institute makes efficient part-time help available, as well as being the source of full-time personnel. I was greatly impressed by the interest these people show in their work. The two stenographer-clerks are graduates of Rice Instiute and are well suited for the efficient operation of the office. From my observation I found all work up to date in spite of the job of renovation being done. I might point out that during my term of office as President of the North Dakota Society of Medical Technologists all inquiries and correspondence with the Executive Office was to my complete satisfaction. This observation is shared with other people with whom I have talked from this part of the country.

Close attention by the writer has been given to the mail service to and from Houston. The mail is picked up at the Hermann Professional Building six times daily. There are two mail deliveries daily to the building. One delivery on Saturday. There is a branch post office located less than a mile from the Hermann Professional Building. Bulk mail can be taken care of at this branch. Another branch office just a few blocks farther away features a drive-in window. Both make for time-saving in this all-important feature of ASMT business procedures.

According to a survey made by the Managing Editor of the HOUSTON CHRONICLE and reported in the HOUSTON CHRONICLE, April 13, 1952, "mail service is pretty good from other cities of the nation to Houston business establishments."

"The survey showed that on the average it takes a letter about 2½ times the normal train time from other cities to reach the CHRONICLE office. This includes the time the letter was in the mail depository in the other city, the time required for processing in the other city, the time it took to come by train, and the time elapsed in Houston before the letter arrived at the CHRONICLE."

From the above it is noted that regardless of the location of the city the processing and handling of the mail is the main time factor and would be no different if the ASMT office were located in Kansas City, Omaha, or any other geographical center.

With regard to air mail I have found the service between Bismarck and Houston especially fast. For instance, a letter postmarked 10:30 AM at Bismarck was received at the Executive Office in the morning mail of the following day. Similar speed has been noted from Houston to this office. Listed below is a partial schedule of air mail out of Houston from Post Office to main points only. Night dispatch has comparable time.

To:	Leave Houston	Arrive Destination	Hours
Chicago	1:40 PM	7:15 PM	5 Hours 25 Minutes
Boston	2:35 PM	2:48 AM	12 Hours 13 Minutes
Chicago	4:40 PM	10:10 PM	5 Hours 30 Minutes
Atlanta	5:40 PM	1:50 AM	7 Hours 50 Minutes
Cleveland, Ohio	4:40 PM	3:59 AM	11 Hours 39 Minutes
Cheyenne, Wyo	1:40 PM	6:45 AM	17 Hours 05 Minutes
Denver, Colo.	4:40 PM	10:55 PM	6 Hours 15 Minutes
Los Angeles	2:35 PM	8:10 PM	5 Hours 35 Minutes
Seattle, Wash.	2:35 PM	5:00 AM	14 Hours 25 Minutes
San Francisco	2:35 PM	10:45 PM	8 Hours 10 Minutes
Portland, Maine	2:35 PM	8:29 AM	17 Hours 54 Minutes
Jacksonville, Fla.	2:35 PM	11:40 PM	9 Hours 05 Minutes
Minneapolis	2:35 PM	10:09 PM	7 Hours 34 Minutes
New York City	2:35 PM	10:23 PM	7 Hours 48 Minutes
Philadelphia	2:35 PM	12:10 AM	9 Hours 45 Minutes
Kansas City, Mo.	2:35 PM	7:05 PM	4 Hours 30 Minutes
St. Louis	2:35 PM	5:46 PM	3 Hours 11 Minutes
San Diego, Calif.	2:35 PM	11:10 PM	8 Hours 45 Minutes

In reviewing the overall picture of the Executive Office, office management, personnel, location of the office and mail service, I feel that it would be indeed difficult to find a more desirable location than that which we now have. Therefore, I urge very strongly that ASMT headquarters maintain its present location. I can see nothing to be gained by moving the office to another city. On the other hand, much is to be gained by maintaining a stable situation.

Respectfully submitted,
C. Patton Steele, Member
Board of Directors, ASMT

ARMY TESTS NEW PLASTIC BAG TO REPLACE GLASS BOTTLE AS WHOLE BLOOD CONTAINER

New plastic bags may replace glass bottles as containers of whole blood for military use if current tests by the Army Medical Service confirm that the plastic holders facilitate transfusions and substantially reduce the bulk of shipments.

Major General George E. Armstrong, MC, Army Surgeon General, announced today that the plastic containers had proved equally valuable in both field trials and hospital use. Blood packaged in the 6 x 8-inch bags occupies only one-half the space required by glass bottles now in use and can be airdropped to troops in combat without breakage.

Physicians at Brooke Army Medical Center, Fort Sam Houston, Tex., and Walter Reed Army Medical Center, Washington, D. C., report arterial transfusions are easier and safer to give when whole blood can be forced into the patient's bloodstream by direct hand pressure on the plastic container. This eliminates the need for special apparatus to build up pressure with the attendant danger of air entering the system.

Determination of the practicality of the new containers for Army-wide use will be made after improved models have been evaluated at Brooke, Walter Reed and two Air Force and two Navy hospitals.

The bags are also used for collecting blood from donors at the test centers. Although they do not have the vacuum pull incorporated in the bottles, the plastic units can fill in eight to 16 minutes with the aid of gravity and the donor's muscular efforts.

Air shipment of whole blood to Korea and other oversea areas will be greatly facilitated because of the small weight and bulk of the plastic containers compared to the glass bottles. Storage of the empty bags will require one quarter of the space occupied by the blass bottles.

Each bag comes collapsed around 75 cc. of anticoagulant, ready to receive blood from a donor. One type comes with donor tubing attached which may be used as a hanging device; a second has a measuring device on its side to indicate the amount of blood it contains.

SHORT COURSE IN HEMATOLOGY

A course in Hematology will be given at the Thorndike Memorial Laboratory from June 1, 1953, through June 12, 1953. This same course will be repeated during the two weeks beginning June 15, 1953. These courses are designed to offer advanced work in Hematology to technicians, physicians, and pathologists who are familiar with the usual clinical laboratory methods. The tuition fee is seventy-five dollars ($75.00). Early registration is essential. Apply to Geneva A. Daland, Thorndike Memorial Laboratory, Boston City Hospital, Boston, Massachusetts.

FILM AVAILABLE

The Audio-Visual Production Services of the Communicable Disease Center has recently released the following production:

F24: A MYCOLOGICAL SLIDE CULTURE TECHNIQUE

Data: Sd., Col., 4 min., 36 frames, 1951.

Purpose: To aid in training personnel in the making of slide cultures.

Audience: Laboratory technicians; instructors in colleges, and schools of medicine and public health.

Content: In the study of fungi it is often necessary to observe the undisturbed relationship between reproductive structures and mycelium. This film-strip shows how this may be accomplished by growing fungi on glass slides in a moist chamber. It shows in detail:

1. The materials required
2. The mechanics of making the slide cultures
3. Results obtained in comparison to slides made from regular types of cultures.

Comments: The method shown in this filmstrip is based on that described by Dr. R. W. Riddel, London School of Hygiene and Tropical Medicine.

All CDC films are available on free loan for the training of personnel in the fields of public health, medicine, biological and allied sciences.

The majority of CDC films can be purchased from the United World Films, Inc., 1445 Park Avenue, New York 29, N. Y. Price lists are available from CDC or United World Films, Inc.

SHORT COURSE IN CLINICAL PATHOLOGY

A short course designed to familiarize a selected group of Army medical officers and allied scientists with advances in the field of clinical pathology was held December 8-10 at Walter Reed Army Medical Center, Washington, D. C.

More than 30 leaders in various aspects of the subject, including officers on duty at Walter Reed Army Hospital and the Army Medical Service Graduate School, Walter Reed Army Medical Center, served as instructors.

Special emphasis was placed on the subjects of blood banking, hematology, and antibiotics, but other matters of medical interest were presented. Some of the sessions were featured by demonstrations in the fields of parasitology, bacteriology, hematology and methods of slide study.

Medical officers and scientists enrolled for the course were invited to attend a two-day symposium on leptospirosis to be held the same week at the Army Medical Service Graduate School, Walter Reed Army Medical Center.

A.S.M.T. NATIONAL LABORATORY OPEN HOUSE DURING HOSPITAL WEEK MAY 10-16, 1953

Before you read about the convention turn back to the advertising section and read page E.

1953 A.S.M.T. CONVENTION

Plans are progressing for the 21st annual convention of A.S.M.T. to be held at the Brown Hotel in Louisville, Kentucky, June 14-18, 1953.

Springtime in Kentucky is beautiful! Bordered by the Ohio River on the north and west; by the Big Sandy on the northeast; by the Cumberland Mountains with the scenic Great Smoky Mountains on the southeast and its southernmost portion dotted with rivers and lakes Kentucky will give a welcome to the medical technologists coming through those borders into its interior where the bluegrass farms and historic spots await them.

The chairmen of the commitees who have been appointed are zealously working on the plans to make the Kentucky concvention remembered for years for the program, the exhibits (scientific and technical), and the entertainment and our cordial hospitality.

MAKE AND KEEP A NEW YEAR'S RESOLUTION TO COME TO KENTUCKY FOR THE 21st ANNUAL CONVENTION IN 1953! OUR SOCIETY WILL BE "OF AGE" THEN!

Miss Mary Benedict Clark, AB, MT (ASCP),
General Chairman, 1953 ASMT Convention,
301 McCready Ave., Louisville 6, Kentucky.

NOTES FROM THE PROGRAM COMMITTEE

A. Final Announcements About the Awards Available for the Convention:

1. The Hillkowitz Memorial Award of $200 for a paper reporting original research.

2. The ASMT Awards of $75, $50, and $25 for scientific papers. The successful contestant will also receive a certificate of merit.

3. The Registry Award of $50 for a scientific paper.

4. The Parasitology Award of $25 for the best paper on Parasitology. The subject matter for the ASMT, Registry, and Parasitology Awards does not have to represent original research.

5. The ASMT Awards for State Society and for individual member exhibits. We hope that the generous awards which are available will stimulate more of our medical technologists to submit papers for the 1953 Convention Awards.

Program Rules

1. The deadline date for papers to be received by the Program Committee Chairman from medical technologists desiring to present papers in Louisville and also to compete for Convention Awards is March 15, 1953.

2. Only ASMT members are eligible to compete for the Hillkowitz Memorial Award, the ASMT Awards, and the Parasitology Award. Any registered medical technologist may compete for the Registry Award. All competitive papers must be presented in person or by proxy at the Convention.

3. All papers read at the Convention or submitted to the Society become the property of the American Society of Medical Technologists and may be published in the American Journal of Medical Technology, only, because the Journal is copyrighted. Papers published elsewhere will not be accepted.

5. All audio-visual aids and professional technicians to operate them will be supplied by the Speakers' Supply Committee.

6. Five (5) copies of each manuscript must be submitted to the Program Committee Chairman. These must be typewritten, double-space, on regular typewriter paper.

7. Two (2) copies of the manuscript must be submitted by those not competing for Awards. They are subject to the above regulations.

8. Prize papers from State Contests, which are to be considered for presentation and for further awards, must be in the hands of the Chairman of the Program Committee, March 15, 1953.

C. Program

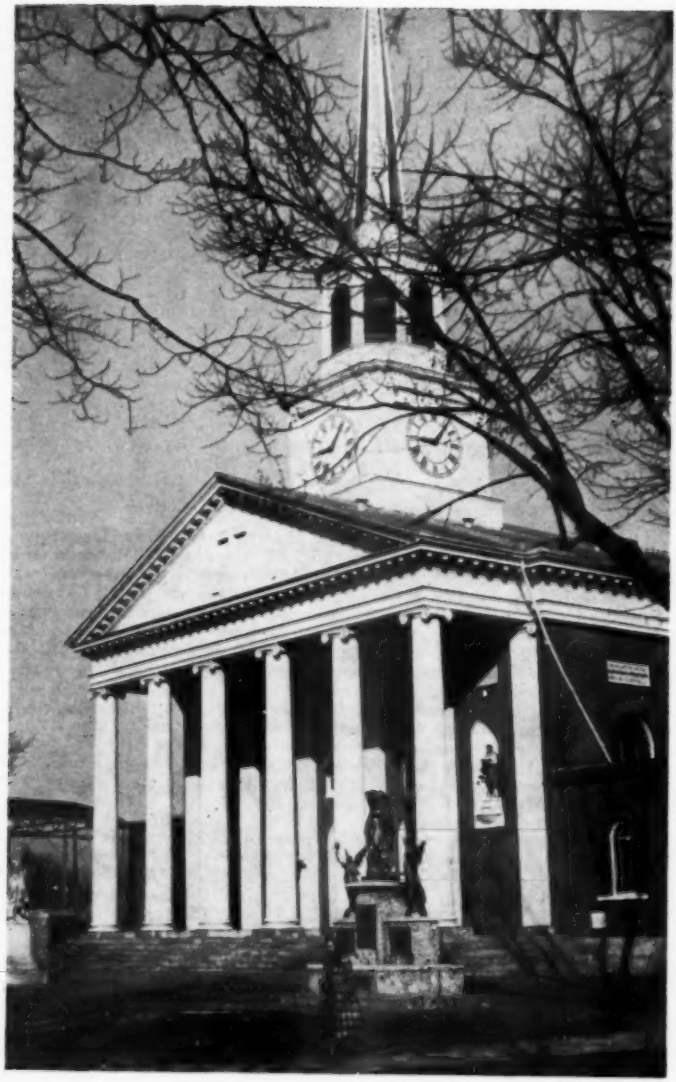
Because of the interest manifested in Society Committee Workshops, as indicated by the response to the letters asking for program suggestions, sent out to all State Presidents last Fall, the Workshops will not be scheduled concurrently, so that each of the members of ASMT may have an opportunity to attend all of them.

Among some of our outstanding guest speakers on the Program are the following:

Dr. Opal Hepler, Northwestern University, who will discuss and demonstrate prothrombin studies; Dr. Robert Rohn, Indiana Medical Center, who will bring us up-to-date on vital staining in hematology; Dr. G. E. Quinby, CDS, Savannah, Georgia, who will inform us about some very recent work on the serology of murine typhus; Miss Charlotte Street, Research Assistant to Dr. Papanicolaou of Cornell Medical College, New York, who will tell us about some research studies in exfoliative cytology; Dr. Charles Croft, the Ohio State Department of Health, who will treat of the techniques used in virology. Many of the medical technologists have submitted very interesting and timely subjects for the program. We have many more very excellent guest speakers. Your program committee will report to you more about the development of the Program in the March issue of AJMT.

Program Committee

Miss Rachel Lehman, 3939 North Capital, Indianapolis, Indiana
Miss Nila Maze, 6106 North Carvel, Apt. C 3, Indianapolis, Indiana
Miss Sarah Hanna, 1439 East Third Street, Salem, Ohio
Miss Ruth Bluemlein, Fort Wright, Kentucky
Mr. Ed. Crowe, Health Center, U. of K., Lexington, Kentucky
Sister M. Simeonette Savage, 851 South Fourth Street, Louisville, Kentucky,
CHAIRMAN



St. Joseph Proto-Cathedral.

ENTERTAINMENT-LOUISVILLE, KENTUCKY, 1953

A week of fun—parties, harness racing, and sightseeing in Louisville and the historic surrounding area—is planned for the annual convention of the American Society of Medical Technologists.

For your visit to this city, retaining still an "Old South" atmosphere in the midst of the bustle and excitement of thriving industrial growth, the entertainment committee has mixed these two facets of Louisville's charm to make your stay a memorable one.

For early arrivals who plan a long week-end here before business begins Monday, the entertainment committee will provide informal sight-seeing on Sunday afternoon. Thus, visitors will have the opportunity to drive through the lovely parks for which Louisville is famous, to see Churchill Downs, the campus of the University of Louisville, and the charming residential areas that are mushrooming at the edges of the town.

The Brown Hotel's Bluegrass Room, one of the town's choice, small supper clubs, has been reserved for a reception for Medical Technologists on Sunday evening. The Bluegrass Room takes its name from the huge photographic murals of Kentucky stock farms that line its walls. It has long been the mecca of Louisville residents looking for a good dinner topped with an excellent floor show and music for dancing.

All day Monday we'll be busy with meetings, conferences and discussions, but when evening comes we'll be off in the cool June evening to attend the harness races at the Kentucky State Fairgrounds. Here you'll get a taste of Kentucky's racing spirit and the excitement of "pulling in" the bright colors of your favorite horse which is heightened by the whirr of sulky wheels and the shouting crowd.

Tuesday's entertainment will consist of a different kind of excitement—in the busy, throbbing world of industry. Two of Louisville's biggest industries are the manufacture of whiskey and the processing of tobacco. Here, too, is made the famed "Louisville Slugger," favorite bat of the big league baseball teams. So—a bus tour Tuesday will take us to visit the huge distilleries—with their great testing laboratories, their tremendous production areas, and the seemingly endless bottling lines—and the tobacco plants —which annually turn out more than 12 billion cigarettes. Then the tour will stop at the Hillerick and Bradsby Company to watch the production of a "Louisville Slugger."

The scene will change on Wednesday. There will be a trip to Bardstown, Kentucky, the site of "My Old Kentucky Home" as well as the heart of Kentucky's "little holy land." There will be a visit to the beautiful wooded estate, Federal Hill, where the renowned Kentucky lawyer and U. S. Senator, Judge John Rowan, began in 1795 the building of a fine Colonial home made immortal as "My Old Kentucky Home" by Stephen Collins Foster. A reproduction of Independence Hall, the house was completed in 1818 and was used continuously by the Rowan family until 1922 when it was sold by the last of the Rowans to be used as a State shrine. The entire framework of the house is held together with wooden pegs. The lovely grounds include Judge Rowan's old log law office and the original slave quarters.

In Bardstown we will also visit the St. Joseph Church, original seat of the diocese of Louisville and the first cathedral built west of the Allegheny Mountains. Recently it was from St. Joseph Church that thieves, in a break-in that received nationwide publicity, took several highly-valued original oil paintings which have been attributed by authorities to master artists.

On the town square is Bardstown's historic Talbott Tavern Hotel, continuously in business since 1779, and still renowned for the excellence of food served.

Before going to Bardstown or on returning to Louisville we may have a glance at the Southern Baptist Theological Seminary, the Presbyterian Theological Seminary and the new Catholic St. Thomas Seminary.

"MY OLD KENTUCKY HOME"
Where Stephens C. Foster wrote famous songs.

Back in Louisville we are planning a special dinner of Kentucky burgoo. This delectable soup—a complete menu in itself—will have been simmering away for well nigh 24 hours before it is spooned into a bowl for you. The Kentucky recipe for burgoo is traditionally, though with some dissent, attributed to an old Negro chef at Lexington's Idlehour Farm, the stock farm of the late Col. E. R. Bradley of race horse fame.

The week's festivities will end with the annual banquet Thursday evening with all the trimmins.

We have on hand volumes of information about other places you may want to see on your way here or on your return trip home. We just couldn't include everything 'cause there are just too many wonderful places around Louisville to see in so short a time and have a convention, too, and someone told me that there are a few things to discuss, business ya know. You can't come all the way to Kentucky without seeing the beautiful race horse farms in Lexington and Mammoth Cave; maybe you'll want to go home by way of the Smoky Mountains or go to Kentucky Lake to fish and stay at the new Kenlake Hotel. We'll tell you more about these places later. Of course, if anyone wants to come May 1st, you can get in on the running of the Kentucky Derby. And don't forget the "open house" at the Registry office at Muncie, Indiana, on Saturday, June 13th, and Friday, June 19th.

See you **all** in June.

Miss Mary Maloney, Chairman,
2067 Eastern Parkway, Louisville, Ky.

REPORT OF HOSPITALITY AND TRANSPORTATION COMMITTEE A.S.M.T. 1953 CONVENTION

Louisville, The Gateway to the South, is serviced by the following railroads: The Louisville and Nashville, Monon, Pennsylvania and the Central which arrive and depart from Union Station. The Illinois-Central, Baltimore & Ohio, and Chesapeake & Ohio arrive and depart from Central Station. Both train stations are in the heart of Louisville and in easy access to the Brown Hotel. The Southern Railway System has its depot at 4th and Confederate Place.

The Greyhound Bus Terminal is one block from the Brown Hotel.

Standiford Air Field in suburban Louisville has flights from American, Eastern, Lake Central, Piedmont and T.W.A. airlines.

Information booths will be set up in the depots and airline administration building by the hospitality and transportation committee. There will be someone on hand to greet "you-all." So here's hoping we see you in Louisville.

Co-chairmen: Miss Jean Michels
Miss Jean Quick

SCIENTIFIC EXHIBITS

Just a reminder that it is not too early to reserve a booth for your scientific exhibit. Start now to prepare your exhibit for the 1953 ASMT convention and write to Oscar M. Alton, Norton Infirmary, Louisville 3, Ky., for a reservation.

The backwall of the booth will be blue repp, flameproof draped material, eight feet high with dividers or side rails three feet high covered with the same material as the backwell. A table is furnished. Covering for the table is to be furnished by the exhibitor.

Instructions for shipping will be sent after the requests are received.

Please check the following and return to the above address.

1. Size of booth desired. (Give first and second choice) 4 x 7 ft. 4 x 8 ft. 4 x 9 ft.
2. Counter tables desired. (The table is 20 inches deep.) 4 ft. 5 ft. 6 ft. 7 ft. 8 ft.
3. Chair needed Yes No
4. One electric outlet furnished. Additional outlets $7.50 each. Extra outlets needed 1 2 3
5. Headboard sign 1 x 6 ft. One or two lines to read:

(Please Print)

Name and address of applicant responsible for exhibit _____